American Machinist

August 31, 1932

How Much

Shall We Spend on Dies?

Examples from the automobile body field illustrate general principles governing the relation of die design and cost to production runs

PRESS die design today is largely a matter of economics. Where the runs are large and the cost can be distributed over many pieces, refinements are justified that have no place in small-lot production. But whether small or large quantities are involved, the problem is always one of accomplishing the desired result at least cost. The result sought for is not a beautiful die design but a piece of stamped metal, safely produced. Any short cuts that reduce operating hazards and the unit cost are all to the good.

While the examples chosen are taken from the specialized field of automobile body production, the principles involved are by no means limited to this class of press work. It just happens that the tool designers of the Seaman Body Corporation have applied considerable ingenuity in tackling these problems from an economic as well as an engineering point of view. Through their courtesy we are able to present some of their ideas to readers of *American Machinist*. Every die illustrated is used for making sheet-metal parts for the new Nash bodies.

Figs. 1 and 2 well illustrate how far design refinements can be carried in one case and short cuts can be made use of in the other. The front door draw die, Fig. 1, has renewable tool steel liners for all moldings and sharp corners and these can be interchanged for different models. Tool steel inserts provide for shimming to new dimensions or for alterations outside the die body proper. In order to save metal in the window opening for other uses, in a previous operation a perforation is made leaving only sufficient metal to take care of the draw at the molding and corners. Low production doesn't warrant saving of material in the second piece, the object merely being to relieve the metal in the draw area.

In the more elaborate die, the drawing of the window molding follows an unusual sequence of operations. During the first stage, heavy spring pressure on the punch side allows the metal in the window to be drawn into the molding up until the point where the molding corners are struck. At that instant the inner pad on the punch comes into play and flanges the inside edge of the molding at *A-A*, thus effectively locking the metal and preventing further draw from the window area. Stretch then takes place in the metal within the locked flanges. Since the metal is stretched over the punch as at *B*, the side air pad inserts need only push in

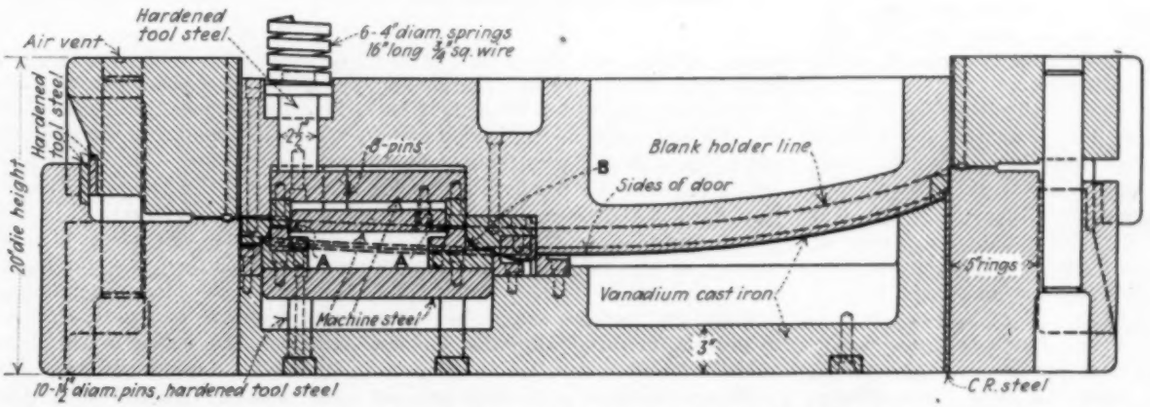

Fig. 1—Drawing of the window molding is done in two stages in this high-production die for a Nash door

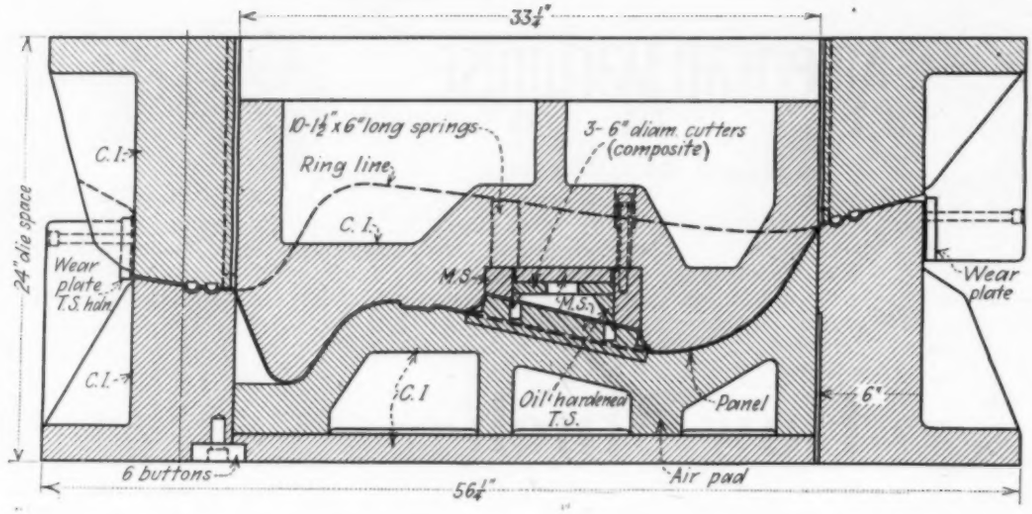

Fig. 2—This low-production draw die is made up largely of cast-iron parts. The only hardened steel parts are the three cutters for relieving the metal in the window draw

the corners at the desired points, instead of presenting a full contour, as in an embossing die.

Contrasted with the refinements in the door die is the simplicity of the design of the draw die, Fig. 2, for the upper panel of a Victoria body in which production is relatively small. It is made largely of gray iron (instead of vanadium cast iron) with comparatively few steel inserts, and these only in the draw area of the window panel. In place of blanking out the window space in a separate die, and using the material elsewhere, this design incorporates three relief punch disks in the window area. This is not so much a shearing operation as it is one of puncturing the taut diaphragm an instant before it would rupture from over-stretching. Restraint of the metal from wrinkling during the drawing of the window molding is by spring pressure between the punch on the die side and the spring pad on the punch side, but no attempt is made to lock the metal in the final stage of the draw.

Standard composite punch disks are employed, made of tool steel cutting edges resistance welded to wrought iron, which neither warps nor hardens during the heat-treatment of the former. The thickness of the machine steel spacer behind this disk is found by trial and error as it determines the point at which rupture takes place.

Blank holder "ring lines" are developed from the "dummy" and provide for no more draw than is absolutely necessary, thus reducing the size of steel sheet required. These lines are laid out so as to eliminate any buckle or wrinkles in the free metal when it is placed on the lower ring prior to tripping the press.

Both these draw dies operate in double-acting presses with pneumatic-cushion beds. To make them self-contained for handling in and out of the press, buttons are screwed into the lower draw ring to prevent the air pad from falling out. In both designs the die pads rest upon air cushion pins projecting through the press bolster plate, but in the door die ten hardened pillar pins, fixed in the lower draw ring cross pieces, project through the die pad to support an auxiliary punch pad for the inner draw ring of the window. All castings are made exceptionally heavy to provide for future alteration for new models without destruction to the parts.

Where the draw is shallow and the piece relatively small, great saving in die cost is possible by substituting a stretcher die for a compound draw die. No upsetting is permissible, however, the limitations being straight draw and embossing work. In a stretcher die, punch and die are interchanged compared with their functions in a double-acting press. In place of a double-acting punch there is a stationary punch and a movable draw ring supported by pins from the pneumatic cushion. The effect is like pulling a hat down over the head and ears while grasped between the fingers. Momentarily, the head stays still (assuming a surprise attack

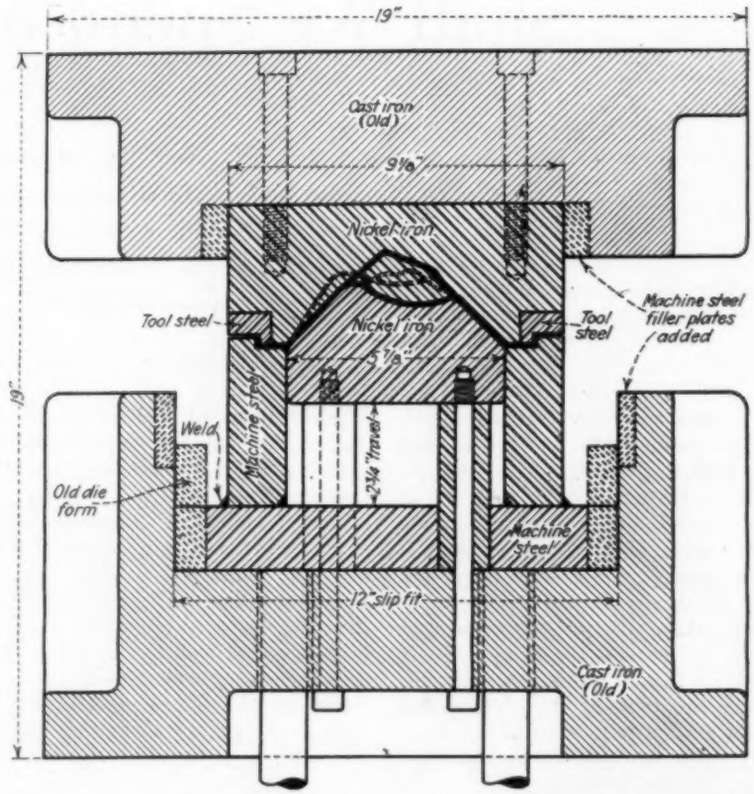

Fig. 3—For straight draw and embossing operations a stretcher die offers the most economical tool construction. The offset clamps the work

from the rear) while the brim moves down, sweeping all before it. Fig. 3 illustrates this principle applied to a die for forming the inside header panel next to the windshield. In this design the sheet is clamped by an offset instead of the conventional drawing head. The lower draw ring plate rests upon pins that extend through the main die body directly to the press air pad.

Aside from the fact that a large double-acting press doesn't have to be tied up with small work of this sort, production is considerably increased because of the inherently higher speeds available in a single-acting press—25 to 30 strokes in the latter as against 7 to 10 per minute for the former. Several other points of economy are noteworthy. In the first place, an old die set was revamped to serve the purpose by machining it out to 12-in. width and inserting machine steel filler plates for wear resistance. Straight sections of machine steel plate arc-welded to a similar flat base plate make a simple and inexpensive draw "ring," finished on a planer. The only contour work required is on the upper and lower embossing blocks, both made of nickel cast iron. Nickel iron is the choice here because it holds up at the corners better than vanadium iron. The latter, being softer, is used almost exclusively for drawing work as its velvet smooth surface does not tend to tear nor scratch the sheet. Because the chief wear and tear from drawing friction occurs at the offset at the upper drawing edge, this part is hardened tool steel.

Another method of anchoring the edges on a stretcher die is to flange up the sides and ends of the sheet between the punch and the outside die shell. Fig. 4 is an example of such design applied to a draw die for an instrument panel. The same principle of inverting the punch and die applies. Once turned over, the edge does not slip as the flange is swept down the sides of the main die body. Method of support of the dome pad is the same as before, but for strength and service considerations the material is cast Kinite in place of nickel iron. Like the previous example this die set can be finished largely with planer cuts on the sides and contour forming on the ends. The only curve finishing required is on the Kinite pad and its mating surface.

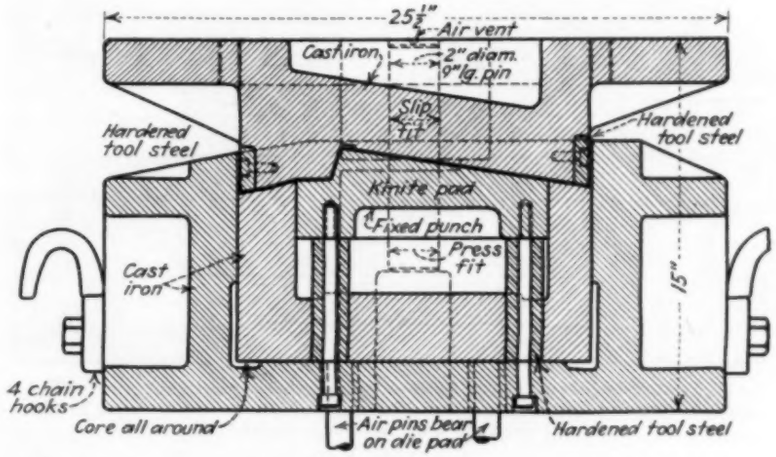

Fig. 4—Another method of anchoring the edge of the sheet in a stretcher die is to flange it in the first part of the stroke

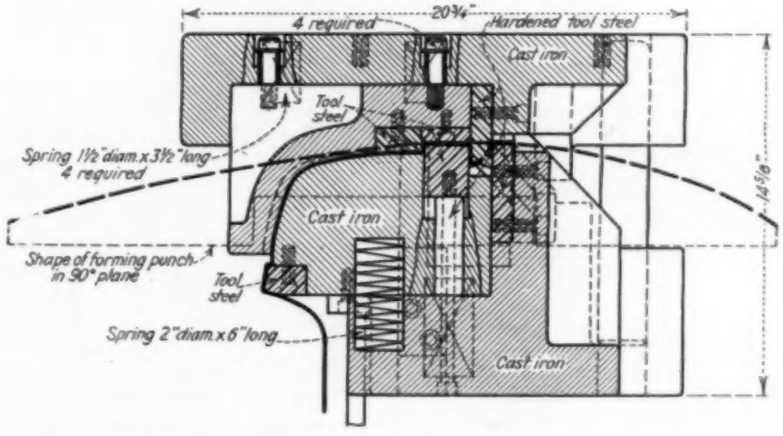

Fig. 5—Trimming, flanging, and forming are combined in this modified stretcher die

Another modification of a stretcher die in which forming takes place over a stationary stake is exemplified in a die combining the operations of trimming, flanging and forming the deck opening molding on a coupe deck side, Fig. 5. In this drawing, the dotted line shows the actual sweep of the panel and the shape of the punch member on its side. As the cross-section indicates, however, all lines are straight in the other plane, allowing planer work and the use of flat tool steel face plates. This consideration is an important one since it permits the shear edge, after grinding, to be restored to its original position through the use of shims. Another point is that the trimming punch, on its rear side, also acts as a flanging tool. The die spring pad against which the previously formed shell is held is flush with the lower punch at start and is backed by seven springs, 2 in. in diam. by 6 in. long. The hardened tool steel punch plate, over which stretching takes place, in turn is supported on 1¼-in. diam. pillars bolted to the main die base.

Savings in die cost are always possible if a single die can be made to serve several purposes by interchanging some of its parts. Fig. 6 is another example. It shows a die within a die for blanking and piercing a front door hinge pillar. The lower part of the door remains unchanged, and the corresponding part of the main die is not shown. A sub-die set carries the punch and stripper plates for the changeable section of the hinge pillar. To make such a design practical it should be possible to make the changeover in the press without the necessity of removing the main die. This is accomplished through the use of mushroom-head buttons on the stripper springs. In their normal position, these buttons are flush with the inset of both the main punch and the die and hence are undisturbed during the sub-die changes. Hollow-head set screws make such a design possible from an assembly point of view. Mushroom-head pillars, to which the stripper plates are screwed, bear against the spring-backed buttons. To make the change, the operator loosens twelve set-screws, runs the ram up and slides out the complete sub-die.

This spring action through mushrooms is a general practice in all Seaman body dies as it eliminates all accidents caused by stripping screws in repairs, and makes the changes of punches and sections safe, either in or out of the press. Economically it is

right, for springs can be lifted from one die and dropped into the spring holes of another, thus saving more than half the number of springs ordinarily required to be kept on hand.

Combining two or more models in one die without the necessity of any changes or substitutions is even more effective from a cost saving point of view. Fig. 7 represents economy plus. This die forms and flanges in three stages three panels, which vary in width in small steps. All are low-production jobs. Like many another die in the Seaman plant, this one is built up on an old one, to which is added a steel plate on the bottom to make room for an air cushion pad. This plate is backed by the machine air pins and bears against ten 1-in. pins which lift a 1½ x 18 x 40-in. plate, so that the entire die floats on air. The parts that do not float are anchored to the die body through pillars passing through the large air plate.

In the first operation (left), the small step is formed; in the second, the panel is reversed and bent at a right angle; in the third, another right-angle bend is made in the other edge. Work surfaces or edges are tool steel; pressure surfaces, machinery steel or cold rolled stock. None of these steels is hardened since every formed edge is a curved line. The trick here is to plane the edges to shape in a flat bar, bend it to the required curvature, and machine the back straight for attachment to the die body. If a double curvature is involved, obviously one curve must be machined.

Forming right- and left-hand pieces in the same sheet before blanking them apart saves in operating and handling time, and also provides better drawing conditions by having the metal locked. Fig. 8 shows such a combination die for door lock jamb panels. Here again an old die serves for the main bodies, although the materials added are better than the original. The lower spring stripper casting is vanadium cast iron, as is the similar piece in the punch. Corresponding striking members are cast Kinite and hardened tool steel, both backed by cast iron. The small draw bead shown at the right is only 2 in. long and facilitates drawing a bevel section at the latch. Air cushion pin support follows standard practice for these dies. The air cushion pad below makes the die construction independent of any arrangement of pins at the machine, while the buttons that keep the plate from falling out also acts as pillar supports for the die.

Generally, all new die sets are made of welded steel construction in anticipation of being reconstructed and used for other future dies. For many body parts, this procedure cuts the die cost almost in half.

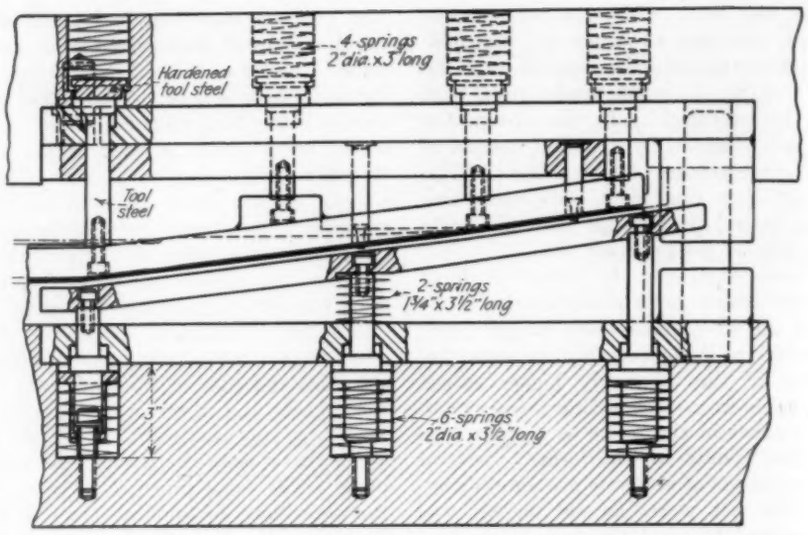

Fig. 6—Through the use of flush mushroom-head buttons on the stripper springs, it is a simple matter to remove the sub-die set in the changeable half of this convertible die

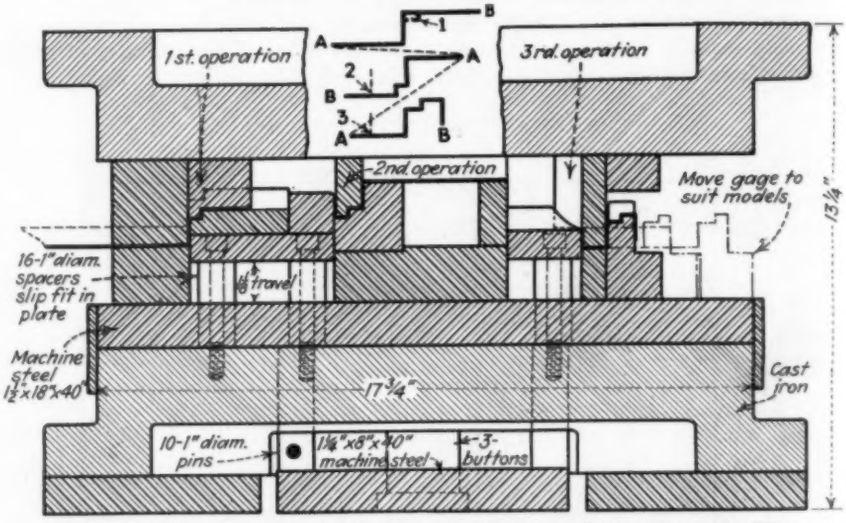

Fig. 7—A three-step die designed to handle three widths of panels. The offset forming edges are planed in flats which are then bent to the desired curvature and the backs machined flat.

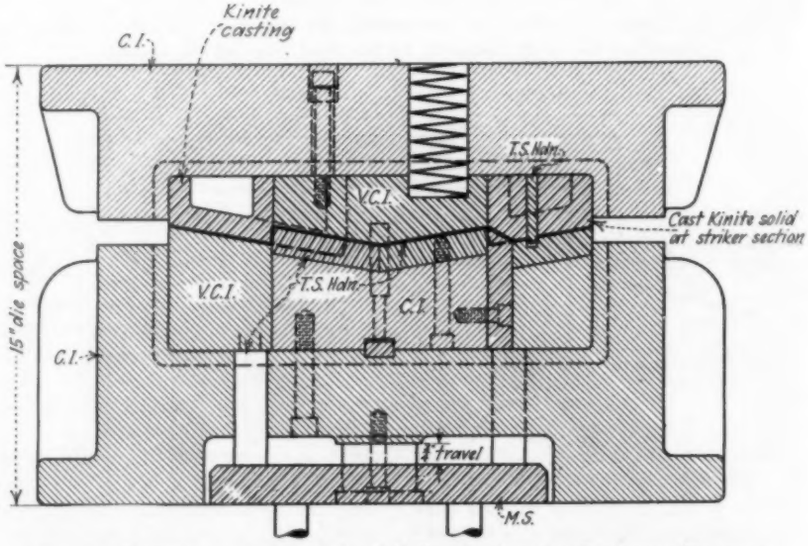

Fig. 8—Forming a right- and a left-hand piece in the same die saves operating and handling time. The pair is blanked apart in a succeeding operation

Standardization
Of Jig and Fixture Parts

PAUL GRODZINSKI
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As a member of the standards committee of the Association of German Managing Engineers, the author has had considerable experience with the establishment of standards for fixture parts. His account of the steps in this direction taken in Germany discloses some of the possibilities for uniformity in devices that are ordinarily regarded as special

WHEREAS, in America, the term "jigs and fixtures" characterizes a distinct group of items, the German technical expression "Vorrichtung" has many meanings. At the beginning of the standardization work, it was, therefore, necessary to describe plainly what was meant by the heading "Vorrichtung" in a restricted sense, for in Germany even machine tools were sometimes included under this classification. Although various published articles on jigs and fixtures are confined to fixtures for the holding of work-pieces while being machined with cutting tools, the committee deemed it advisable to include such devices as are used for locksmith's work, hardening, welding and soldering. For all fixtures, the following characteristics are essential:

1. They should bring the work-piece into contact with the tool in an exact position.
2. They should hold and clamp the work-piece.
3. They should reduce the time required for the work.
4. They should require only a minimum of hand power.

A further demand, which, however, is not imposed on all fixtures, is that the manufactured parts should be interchangeable. In order to establish a fundamental principle, the committee emphasized the following definition:

The fixture (Vorrichtung) serves to adjust the work-piece before being worked upon and holds it in a certain fixed position during the process of machining.

All implements, not coming under this definition, fall under various headings as before. Parts which are simply placed on the work-piece without any clamping device still retain the designation "Schablone" as hitherto. Another important distinction is that between contrivances for holding tools, such as chucks and toolholders, and those used for holding the work.

A summary of the whole task of standardization was based on the following considerations. Working with jigs and fixtures consists of the following operations in consecutive order: preparing, laying in, adjusting, clamping, machining, unclamping, taking out. The second consideration was to decide what means were necessary to carry out the above-mentioned operations. These means are the machine tool on which the fixture rests, the man who fits the work-piece into the fixture and controls the machine, and finally, the cutting tool.

Thus the fixture is an intermediary between man, tool and machine on one side and the work-piece on the other. These two principles, one referring to the consecutive operations and the other referring to the instruments in use are combined in Fig. 1. Thus we are enabled in every case to designate the relation between the operation and its instrument. This table forms the fundamental principle for a working program in the field of jigs and fixtures.

At first, the committee made a simple distinction between the different parts of jigs and fixtures, but because of the growing scope of this work, after a time, it was necessary to analyze more scien-

	Prepare	Lay-in	Adjust	Clamp	Machine	Unclamp Take out
Machine *Jig and Fixture*	A_0	A_1	A_2	A_3	A_4	A_5
Tool *Jig and Fixture*	B_0	B_1	B_2	B_3	B_4	B_5
Work-piece *Jig and Fixture*	C_0	C_1	C_2	C_3	C_4	C_5
Man *Jig and Fixture*	D_0	D_1	D_2	D_3	D_4	D_5

Fig. 1—Standard symbols provide a quick method of designating each step in a machine operation in reference to the devices

tifically the main parts of the fixture and especially the clamping devices. Following the suggestions of the writer, the clamping parts of the fixture have been acknowledged as the principal or main parts. In general, it will be found possible to make the clamping part of the fixture more simple, cheaper, lighter and easier to handle as shown in Fig. 2.

The difficulty of standardizing complete fixtures and of designing some types of standardized fixtures has been discussed. The opinion as to the suitability of such measures is divided. But the standardization of the single parts of the fixture, such as clamping screws and nuts is quite another matter. Such parts should be at the disposal of the designer in various forms, together with standardized screw diameters and lengths as shown in Fig. 3, so as to enable him to choose a suitable screw without having to design this particular part in all its details. He knows that this standard part has already proved its reliability, that it is accident proof and that it is available.

Special Parts

Should it be necessary to exchange the part while the fixture is working, this can be accomplished without undue loss of time and without putting the fixture out of operation. On the other hand, the designer should not be obliged to use standard parts in all fixtures. Rather, it should be left to his discretion as to whether he deems them suitable for his purpose or not. If there is any special difficulty to overcome in the construction, or if the design is intricate, he should first find whether it is possible to avoid a special construction by means of a simple alteration on the finished standard part.

For any one factory, the number of standard parts laid down in the tables may be too numerous; therefore each factory should restrict itself to the number of standard tables it actually uses. Works turning out mass production do not like knurled knobs because such knobs are often handled as many as 1,000 times a day and the hands of the workers suffer. Especially is this the case when soapy water is used. These knobs are primarily intended for adjusting and clamping parts which are not often used and not under a heavy strain. Factories turning out mass production should adopt these knobs only in rare cases.

A limited range of screw threads and lengths is also advisable so as to avoid too extensive a stock. Fig. 3 shows the various definitely standardized forms of handles and knobs for clamping screws and nuts.

Fig. 4 shows one of the standardized tables as it is proposed to place it before the designer. It will be seen that the most important dimensions, finish, material and the important tolerances are included. From this table, standard parts can be manufactured exact to the smallest detail. Tables on clamping screws with star and cross handles, also eye-bolts, are in course of preparation but have not yet been published.

With regard to screw diameters, the selection has also been restricted. The difficulty exists that some branches of industry in Germany use only metric screws, whereas above 10 mm. (⅜ in.) others use bolts with Whitworth threads. The screws under 10 mm. thus have a single standard, whereas for those above 10 mm., two series of thread standards will be necessary, metric and Whitworth. It has been the aim to keep all the other dimensions of screws and nuts as uniform as possible.

For the manufacture of fine mechanical parts small screws are provided, whereas in the construction of railway carriages, the diameter of clamping screws often exceeds 1 in. The following diameters have therefore been agreed upon:

Standard

M4 M5 M6 M8 M12 M16 M20 M24

Optional

½ in., ⅝ in., ¾ in., 1 in.

For purposes of simplification, the relatively often used diameter M14 has been omitted. Particular attention has been given to the design of the end of screw bolt. Whereas it has been the practice to finish the ends of the bolts by the simple process of cutting off and rounding, the committee is of the opinion that the end should be reduced in diameter. Because of the heavy pressure put upon them, when the screws are used as attachment-screws, the end threads are likely to be upset and unscrewing made difficult. Further, it appears to be necessary to make the end convex, so that the pressure is in the center and does not move the work laterally out of position.

In the case of some work-pieces, it is necessary to supply the screw end with a pressure pad which compensates and distributes the pressure over a larger area. The standardization of these pads is also under consideration. Supple-

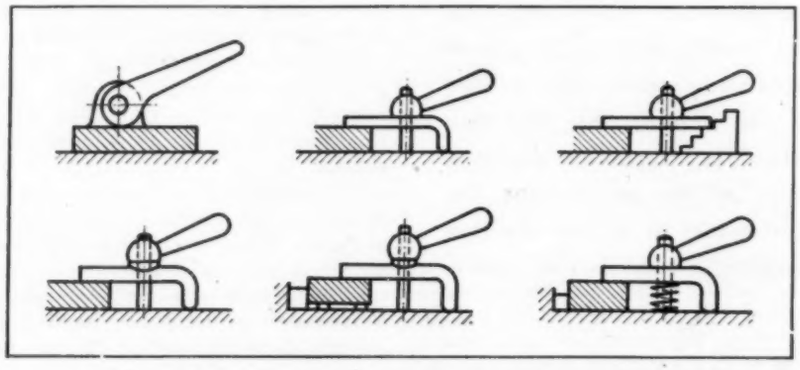


Fig. 2—Clamping arrangements for various purposes are determined so their parts may be standardized

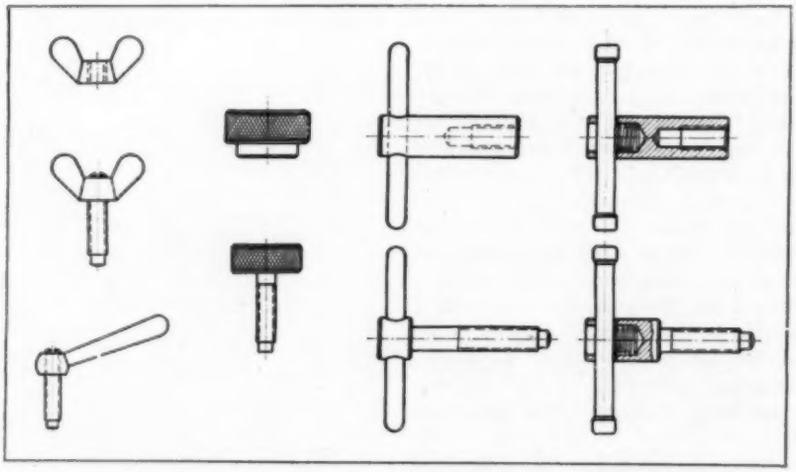


Fig. 3—Knobs and clamping screws are limited in size and variety so they may be made in quantity without entailing excessive stocks

mentary to tension-screws are the so-called convex and concave pads which always guarantee a central position of the screw. As supplementary to the standard tables of clamping screws, other examples are under consideration; also recommended practices for the design of quick clamping devices with screws as the clamping element.

The advantages of standard parts begin with the designing of a fixture. It is not necessary for the designer to devote so much thought to his work, as it is possible for him to select and sketch the elements from the standard tables. Parts which are frequently used are drawn on special cardboard sheets to their actual dimensions; the designer has simply to place these sheets under his drawing paper and trace the particular part required. In this manner, he can obtain an exact outline of even the most intricate part in a relatively short space of time. It also enables him to see at a glance which sizes are most suitable.

In consequence, the work of designing is appreciably reduced, and the designer is at liberty to direct his attention to the more difficult problems. The necessity for making designs of each separate part is also removed; it is sufficient to write in the name or number in the list of materials, and the shop at once knows which part is required. Standard parts that are frequently used are kept in the stockroom; therefore, it is not necessary to manufacture them for each individual requirement. By this means, the time required for the completion of a fixture is considerably shortened. If the fixture is welded from steel parts, the time saved would be a reduction from weeks to days or even hours.

The standardization of parts makes it obvious that in the near future workshops and factories will take up their manufacture. Up to the present time, with the exception of one firm, this has not yet been done, no doubt in consequence of the general economic depression and the fact that the standard tables are not widely known.

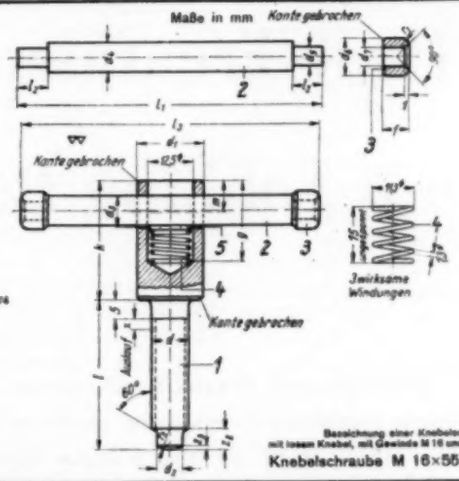
The advantages of standardization in this field are by no means exhausted by what has been said. Worn out or damaged parts can easily be replaced by new ones taken from stock. Further, if a fixture equipped with standard parts should, for any reason, fall into disuse, good standard parts may be salvaged.

DK 621.7.002.52 : 621.882.28 Deutsche Normen Dezember 1931

Knebelschrauben
mit losem Knebel
Vorrichtungsbau

DIN 6306

Maße in mm Kante gebrochen



Bezeichnung einer Knebelschraube mit losem Knebel, mit Gewinde M 16 und Länge l = 55 mm:
Knebelschraube M 16×55 DIN 6306¹)

Gewinde d	Länge l	Kopf d_1	d_3	g	k	m	Zapfen¹) d_2	r_2	z_2	z_3	Knebel d_4	d_5	l_1	l_2	l_3	Ring d_6	d_7	f	r_1
M 10	40	18	8,2	22	32	7	7	5	5,5	1,5	8	5	82	8	80	10	5,1	7	2
	50																		
M 12	50	20	10,2	24	36	9	9	6	7	2	10	6	102	9	100	13	6,1	8	3
	60																		
1/2"	50																		
	60																		
M 16	55	24	13,2	28	40	10	12	8	9	2,7	13	8	122	11	120	16	8,1	10	3
	70																		
	90																		
5/8"	55																		
	70																		
	90																		
M 20	55	30	16,2	32	45	14	14	10	9	2,9	16	9	142	13	140	20	9,1	12	5
	70																		
	90																		
3/4"	55																		
	70																		
	90																		

Stückliste für Knebelschraube M 16×55 DIN 6306

Stückzahl	Bezeichnung		Teil	Werkstoff	Bemerkung
1	Schraube	M 16×55 DIN 6306	1	St 50.11	
1	Knebel	13×122 DIN 6306	2	St 50.11	
2	Ring	16 DIN 6306	3	St 50.11	
1	Feder	DIN 6306	4	Federstahldraht	
1	Rohe Scheibe	8,5 DIN 126	5	St 00.12	

Gewinde: Metrisch nach DIN 14, Gewindegrenzmaße mittel nach DIN 14, Beiblatt 4
Whitworth nach DIN 11, Gewindegrenzmaße mittel nach DIN 11, Beiblatt 4
¹) Ausführung (bei Bestellung angeben): Zapfen gehärtet (in Kali abgebrannt)
Druckstücke und ihre Anschlußmaße siehe DIN . . . . .

Dezember 1931 Arbeitsgemeinschaft deutscher Betriebsingenieure im VDI

Alleinvertrieb der Normblätter durch Beuth-Verlag GmbH Berlin S 14

Fig. 4—In this form, the standard sheet is kept for reference by the jig designer

Cracks in Driving Axles

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The contributions by F. M. A'Hearn, and F. Rattek (*AM*—Vol. 76, pages 267 and 515) are most timely. When a draftsman passes the opinion that spindle fillets are entirely unnecessary, responsible men at the board dub him a paper engineer. But the copyist draftsman is not the only offender in this respect. Not a few shop men, glorying in their self-esteem as essentially practical men, fail to appreciate the need for carefully machined fillets.

Leading machine insurance companies, through the reports they issue, based on the findings of their experienced inspectors, stress the vital necessity that extreme care be taken in the region of keyways and shoulders. Many breakdowns are traceable to omission of fillets.

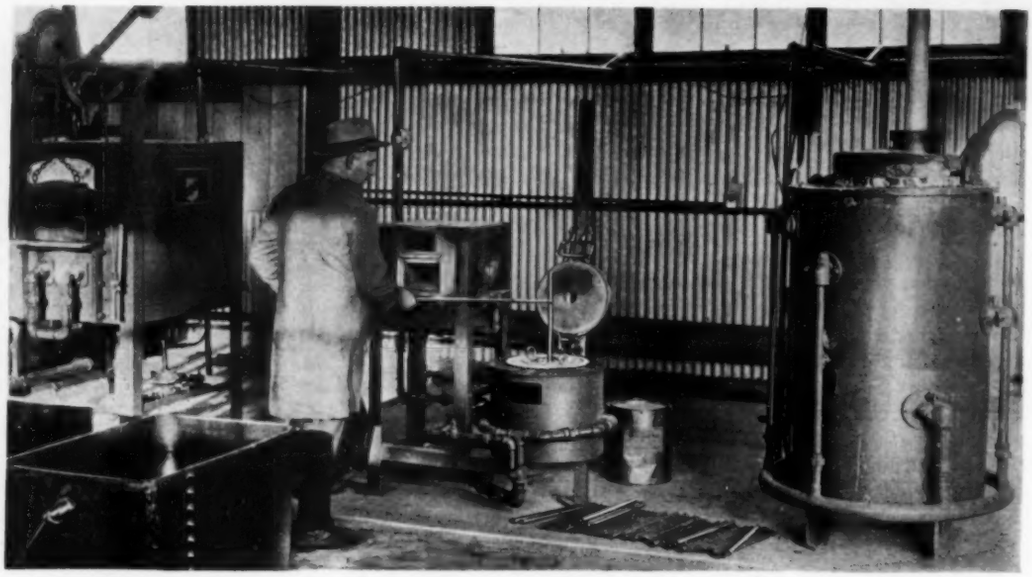
Designers, draftsmen and shop engineers should seriously consider this matter of fillets and radii in grooves and keyways. Experts have demonstrated by actual experiment the injurious effects of such relatively small scratches as those caused by coarse tooling. The British Standards Association officially recommends keyway radii where high stresses, alternating stresses or variable loading are concerned.

Setscrews That Held

JOHN AURES

We had a machine in which there were some cup-pointed setscrews that would persist in working loose. The screws were taken out and the cups were filled with solder, using a soldering iron and letting the solder pile up a little above the sides of the cups. When so treated they gave no further trouble.

From left to right are shown the high-temperature furnace, the small high-speed steel tool furnace, the pot furnace that may be used for cyanide lead or salt bath, and the vertical furnace for gas carburizing



Heat-Treatment On a Jobbing Basis

Economy and flexibility of operation are obtained by certain innovations in a small shop on the Pacific Coast

J. B. NEALEY
American Gas Association

THERE is a growing demand for commercial heat-treating plants that are equipped to handle all types of heat-treating, and that have a personnel of sufficiently varied experience to be capable of solving the many heat-treating problems that are continually rising in nearly all metal-working plants. These consist of taking standard analysis steels and processing them for new products, or as is more frequently the case, of processing the many new alloy steels for the correct balance of physical characteristics demanded for various products.

Such a plant serves Los Angeles, California, and its environs and is known as the Cook Heat Treating Company. The plant was built recently to fill a long felt need in this territory. Among the many furnaces in this plant are two medium-temperature furnaces which are used interchangeably for all methods of heat-treating, requiring temperatures from 1,200 to 1,800 deg. F., such as normalizing, annealing, hardening and carburizing.

These are of the periodic type, built of steel incased brick. Each has a counterweighted door at the front end. The largest is approximately 8 ft. long, 3 ft. wide and 2 ft. high, while the other is slightly smaller. Each of these units is heated by gas burners which fire under the hearth on each side. A large variety and volume of work is put through these furnaces. Much of it consists of heavy oil-well drill tools, shanks, axles and machine parts. Boxes and carburizing compounds are employed when any of these parts are carburized.

A comparatively new type of low-temperature furnace, in which a temperature range from 300 to 1,200 deg. is effectively employed, is used for a variety of work including drawing, tempering, nitriding and the heat-treating of aluminum. The furnace proper closely resembles those just described, the principal difference being in the method of heating. There are four gas burners, two at each end, which underfire the hearth, a large volume of hot products of combustion being accumulated in this part of the furnace and forced up over the work where it is distributed evenly throughout the heating chamber.

The gas burners, which are set in larger pipes or tunnels, are furnished a gas-air mixture from one supply line while air is supplied to the tunnels through another line. The purpose of this air is to cool the gases of combustion and furnish a large volume of hot

air to circulate in the furnace. This cold air application increases the sensitivity of the automatic temperature control that is a part of the equipment.

A motor-operated blower is mounted on top of the furnace, and compressed air passes through a mixer where it inspirates and mixes gas, which has been dropped to atmospheric pressure through a diaphragm. Just above the mixer the air line branches into a Y, and the other leg of which supplies air to the gas burner tunnels. The temperature to be maintained is set on the controller, and when the furnace heat reaches this point, an automatic valve in the air inspirator line cuts down the fuel flow. This reduces the temperature of the circulating air in the furnace. Conversely, when the temperature drops the fuel flow is restored.

Temperature regulation is accomplished with a potentiometer recorder controller actuated through a thermocouple. This controller operates a valve in the air line by means of a diaphragm actuated by the air pressure. The recording pyrometer is equipped with two thermocouples, and when nitriding, two temperature lines are used, one for the heating chamber of the furnace (this is the control couple) and the other for the inside of the box. As soon as the heat is equalized in both, the two lines on the chart coincide.

This furnace is especially effective in low temperature work where positive circulation and complete distribution of heat are so essential. So sensitive is the control that any temperature from 300 to 1,200 deg. F. may be maintained indefinitely automatically with a fluctuation of only 5 deg. either way.

A particular piece of work that is performed in this furnace is the heat-treatment of aluminum where the metal parts are first heated to 900 deg. F., quenched in water, oil and air, and then heated for 12-18 hours at approximately 300 deg. F. The ability to draw from 300 deg. F. up, and nitride at around 1,200 deg. F. makes this furnace a handy unit for any heat-treating plant. One of the outstanding accomplishments in the field of heat-treating last year was the material lowering of nitriding costs when thus treating large quantities of work. Full advantage has been taken of this in the Cook plant.

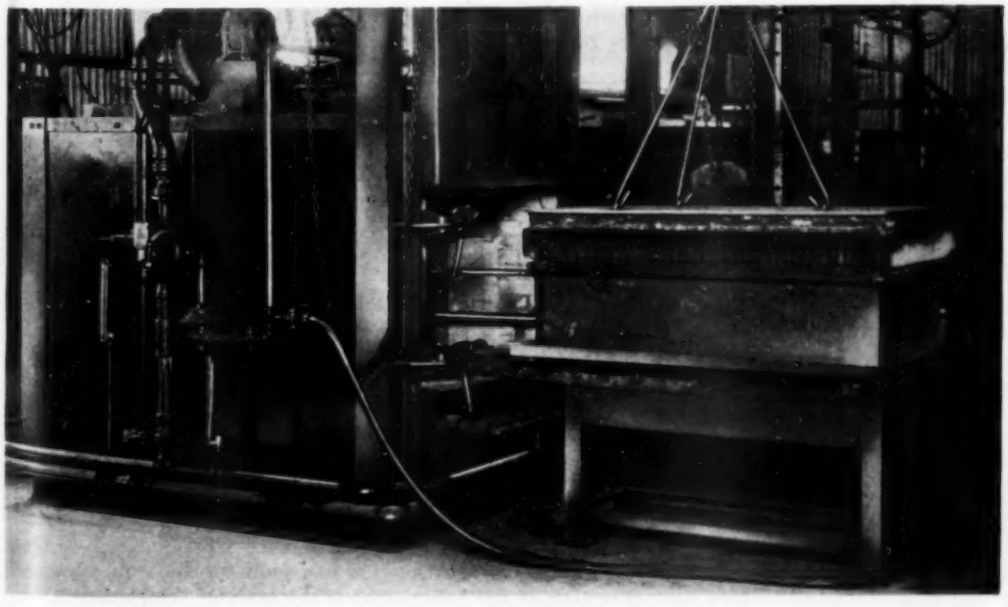
In the accompanying illustration is shown a nitriding set-up. Above the gas pipe and burners around the outside of the box, there is a flange, forming a deep groove in which the cover rests. This flange is full of lead, which is melted by the burners when the cover is put on or removed. Thus an air-tight seal is formed, which effectually prevents oxidation.

Another furnace, which is used in carburizing, is of rather unique design, in that it is cylindrical in shape and contains a vertical muffle or retort of a heat-resisting alloy. Steel incased and lined with refractory material, this unit is 4 ft. high and 2 ft. in diameter and is heated with six gas burners. These burners are cemented into the wall of the furnace and are placed equi-distant from each other both in the horizontal and the vertical planes. They fire into the combustion space between the furnace wall and the retort and tangentially against the inner face of the refractory so as to give the products of combustion a positive whirling motion.

Pump rods, tappets and cam shafts are among the parts that are case-hardened in this unit, but instead of using a solid carburizing compound, gas is introduced or passed through the retort. The gas enters the retort at the bottom and flows out a special aperture in the cover but comes in contact with all parts of the work during its passage. Of course the depth of case depends upon the analysis of the steel, the temperature, the heating period and other factors. This furnace is also equipped with the same method of heating and control as described above. A marked increase in the employment of a gaseous atmosphere in carburizing was one of the outstanding contributions to heat-treating practice last year.

High-temperature work is accomplished in a periodic furnace, rectangular in shape, which is under-fired with two gas burners in front and two in the rear. This and another one of the same type, but smaller in size, are used for heat-treating high-speed tool steels, cutters, reamers and dies. They are fired and controlled exactly as the one described. Another versatile unit operated here is a pot furnace that is employed interchangeably as a cyanide, lead pot or salt bath as the occasion demands. It is an ordinary cylindrical furnace into which pots of different alloys can be set. This piece of equipment is combined with a small rectangular furnace, which is employed both for forging and for heating high-speed steel tools. Both are gas-fired from the same gas-air supply line and blower.

Steel tanks for quenching, both oil and water, are within convenient reach of all the furnaces. They are provided with recirculating pumps to keep the quenching mediums cool, thus yielding uniform results.



Nitriding is done in a low-temperature furnace with the aid of a lead seal around the joint of the box to prevent oxidation

Helical Gear Tooth Measurement

SAM TRIMBATH
Gear Consultant

SIZING helical gear teeth by measuring across ball pins (*A*, Fig. 1) has many advantages, being comparable to sizing spur gears by measuring across pins. In many cases, the measurement can be determined with comparative ease. Some advantages of the method are that: It does not require the use of special measuring instruments other than the ball pins; The gears can be sized without removing from the cutting machine; The measurement is independent of the outside diameter; The tooth thickness of a given gear can be identified without reference to another gear. This last is an important consideration where the gears are of opposite hand.

In spur gearing, it is possible to cut two gears of the same number of teeth at one setting and then measure the center distance at which they will rotate without backlash. As the two gears are cut simultaneously, we would have assurance that the size of each is identical. In helical gearing, it may not be possible to follow this practice, as two gears of the same hand would not function on parallel shafts. To avoid the possibility of opposite hand gears being over- and undersize when fitted to correct centers, some means should be provided for accurately identifying the size of each one separately. Here the ball-pin method has proven invaluable for gears where the helix angle does not exceed 45 deg.

Measuring the thickness of helical gear teeth by means of balls has no doubt been restricted because the calulations are somewhat complex. However, it will be found that the problem can be reduced nearly to the simplicity of determining spur gear measurements across pins through the use of the formula for cutter selection when helical gears are cut with rotary cutters. This formula is: $\frac{N}{\cos^3 \beta} = T$ (Brown & Sharpe, *Formulae in Gearing*) or

$$\frac{\text{number of teeth}}{\text{cosine of helix angle cubed}} = \text{number}$$

of teeth in a spur gear to which the helical tooth shape conforms normal to the pitch helix. The distance from pitch line to ball center (*D*, Fig. 2) is then computed by assuming a spur gear having this number of teeth.

For even teeth, add to the pitch diameter of the helical gear twice the distance from the pitch line to the center of the ball, plus the ball diameter for the measurement across balls. For odd teeth, add to the pitch radius the distance from pitch line to ball center. Multiply this by the cosine of 90 deg. divided by the number of teeth, then by

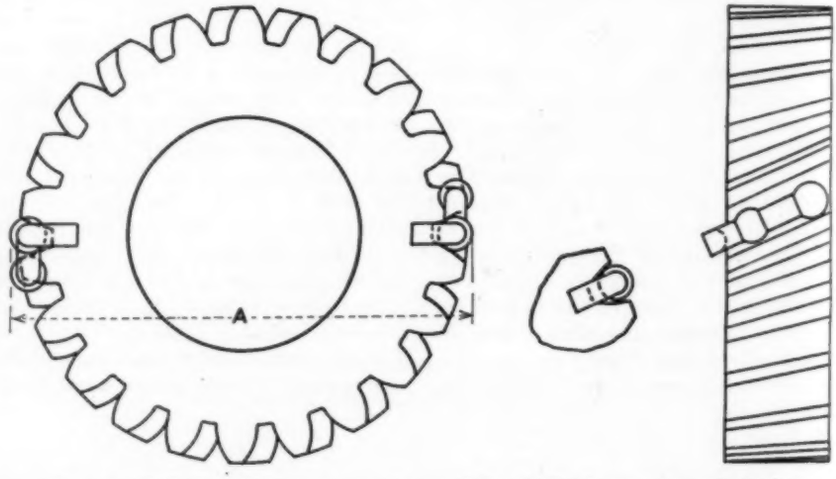


Fig. 1—Ball measurement may be used for helical gears in much the same way that pin measurement is used for spur gears

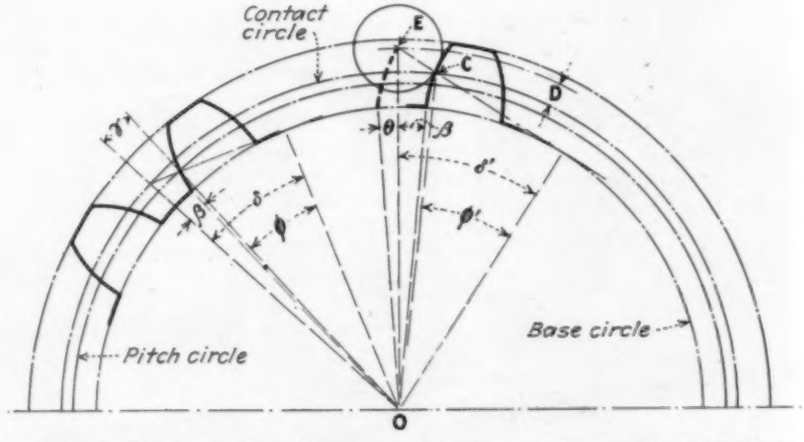


Fig. 2—Determination of a spur gear with a tooth profile equivalent to a normal section of the helical gear is the basis of calculation

WORK SHEET

HELICAL GEAR MEASUREMENT ACROSS BALLS

Data required, No. of teeth (N) 15 Pitch radius (R) 1.0714
Normal pitch (P) 8 Helix ∠ (b) 28°57′ Ball diam. 0.220
Normal pressure ∠ (ϕ) 14°30′

$\frac{N}{\cos \angle b^3} \quad \frac{15}{0.875^3} = \frac{15}{0.6699} = 22.391 = N'$

$\frac{\frac{N'}{2}}{P} \quad \frac{11.1955}{8} = 1.3994$ = Pitch radius of N′

Pitch radius $1.3994 \times \cos \phi \; 0.96815 = 1.3548$ = Base radius of N′

$\frac{90°}{N' 22.391} = 4.020° = 4° 1′ = \gamma$

$4° \gamma \; 1′ + 14° 30′ \; \phi = 18° 31′ = \delta = 0.32318$ in radians

$\delta \quad \text{Tan } \phi$
$0.32318 - 0.25862 = 0.06456 = \beta$ in radians

$\frac{\text{Ball radius } 0.110}{\text{Base radius } 1.3548} = 0.08119 = \theta + \beta$

$\theta + \beta \quad \beta$
$0.08119 - 0.06456 = 0.01663 = \theta = \text{Tan } \delta' - \delta' \quad 20° 43′ = \delta'$

$\frac{\text{Base radius } 1.3548}{\cos \delta' \; 0.93534} = 1.4485$ = OE, center N′ to ball center

OE − Pitch radius (N′)
$1.4485 - 1.3994 = 0.0491$ = D, pitch line to ball center

EVEN TEETH	ODD TEETH
= 2D	0.0491 = D
= Ball diameter	1.0714 = Pitch radius (R)
= Pitch diameter (2R)	1.1205 = R + D
= Distance across balls	R + D $1.1205 \times \cos \frac{90°}{N} \; 0.99452 = 1.1144$
	$\frac{2}{2.2289}$
	Ball diameter = 0.220
	Distance across balls = 2.449

Fig. 3 — Where many gears are to be checked, a standard form will save time and decrease the chance of error

two and add the ball diameter for the measurement across balls.

Work of this kind is much simplified through the use of forms, a sample of which is shown in Fig. 3. Their use tends to avoid mistakes and the necessity for assimilating a lot of technical data, a matter that may consume considerable time when work of this kind is done at long intervals. When any considerable number of calculations are to be made, their use is almost indispensable. The necessary formulas for making the computation are included in the work sheet. With reference to Fig. 2, they will be readily understood. Angle θ is the difference between the tangent of δ' and δ' expressed in radians; angle δ' is found by reference to a table of involute functions (Buckingham's book, *Spur Gears*).

An example has been worked out for a gear of standard tooth thickness or $\frac{3.1416}{2P}$ and filled in the form shown in Fig. 3. For gears under standard thickness, β increases. To determine the measurement divide the amount under standard tooth thickness by the pitch diameter of N', and add this to the value of β in the calculation. For example, to reduce the tooth thickness 0.005, $\frac{0.005}{2.7988} = 0.00179 =$ increase in β. However, any necessary reduction in tooth thickness from standard, must be gained either from experience or a consideration of the other factors involved (see the article "Pin Measurements and Backlash," *AM*—Vol. 76, page 588) and can be expressed just as readily in terms of a reduction in measurement across balls as in terms of tooth thickness. For this reason, computation of the standard measurement is usually sufficient.

From the above, it can be seen that the computation is quite similar to determining the measurement of spur gears across pins. In fact, the same form can be used for both spur and helical gears by using the actual number of teeth N instead of N' when computing spur gear measurements.

It will be noted that the pitch radius of the assumed gear N' is larger than the actual pitch radius R. For this reason, great care must be taken in determining angle δ' for helical gears, especially when the pitch is coarse and the helix angle large, as the radius of N' may be such that one minute's difference in the angle would affect the computation appreciably. In other words, the use of the pin method in spur gearing is more or less restricted to gears of such size as can be conveniently measured with micrometers, and the calculations are direct. In helicals, the tooth shape normal to the helix may conform to spur teeth with many times the number of teeth in the work, and the diameter of assumed gear N' may be much larger than the work itself.

Another restriction to the use of balls for measuring helical gears is the problem of holding and locating the balls or in obtaining balls of a given diameter. One solution that has worked out well in practice has been the substitution of ball-pins as shown in Fig. 1, an enlarged view of the pin being shown in Fig. 4. Diameter D should be held close to the ball size used in computing the measurement, while the diameter in the opposite direction D' can vary 0.001 to 0.002 minus without affecting the measurement appreciably. The distance between the ball sections of the pin C should be no greater than necessary for convenient handling. The object of having two ball sections is to provide a means for retaining the pins in the teeth while adjusting the micrometers to the work. Still another method would be an arrangement as shown in Fig. 5, where the ball pin is attached to a small plate, allowing the pin to accommodate itself to various angles.

The problem of accurate ball location when the number of teeth is odd would be somewhat simplified by using one ball pin and measuring across the top of a tooth diametrically opposite, but certain advantages would be lost, as the outside diameter would have to be taken into consideration.

As the helix angle increases and the number of teeth decreases, the problem of accurate location of the balls becomes more acute, and it is probably advisable to restrict the method to gears of 45 deg. or less and to numbers of teeth 10 or greater. However, when care is used in location and the computation is accurately made, these limitations can no doubt be exceeded.

Exact limitation regarding the use of the method would be difficult, if not impossible, because of the great number of factors involved. However, helical gears operating on parallel shafts unsually have helix angles 45 deg. or less. As the method has proven applicable in practice to such cases, it covers a large range of work.

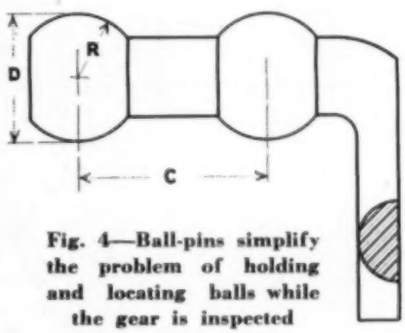


Fig. 4—Ball-pins simplify the problem of holding and locating balls while the gear is inspected

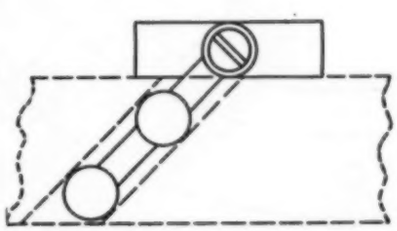


Fig. 5—An alternate design uses a ball-pin pivoted to a flat plate

Contour Calculations for Forming Tools—III

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Chief Tool Designer,
Tyson Roller Bearing Company

Three methods of determining the correct profile of flat finishing tools were covered in Articles I and II of this series (*AM*—Vol. 76, pages 893 and 933). The author now demonstrates two ways to calculate rough forming tools

ROUGHING tools should be designed and calculated with the same care exercised for finishing tools. The final finish obtained on the product, and also the life of the finishing tool, depends largely on the accuracy of the roughing tool. Regardless of the size of the product, second roughing tools (those immediately preceding the finishing tool) should be calculated to leave from 0.005 to 0.010 in. on the product for the finishing tool to remove. This is shown clearly in Fig. 18. In addition, the undercuts for the grinding operation have been omitted. All points should be calculated on the product as for Fig. 3 in Articles I and II of this series.

If two roughing tools are used, the first may have exactly the same profile as the second but should feed in a little more than one-half the distance from

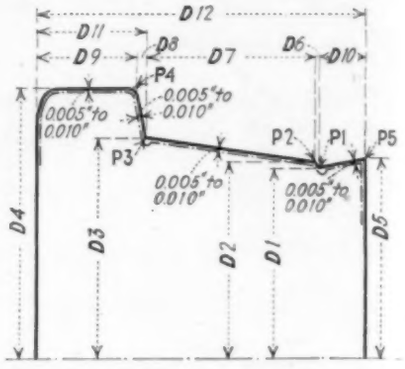


Fig. 18—Calculations for the last roughing tool are made to leave an allowance of from 0.005 to 0.010 in. on the product

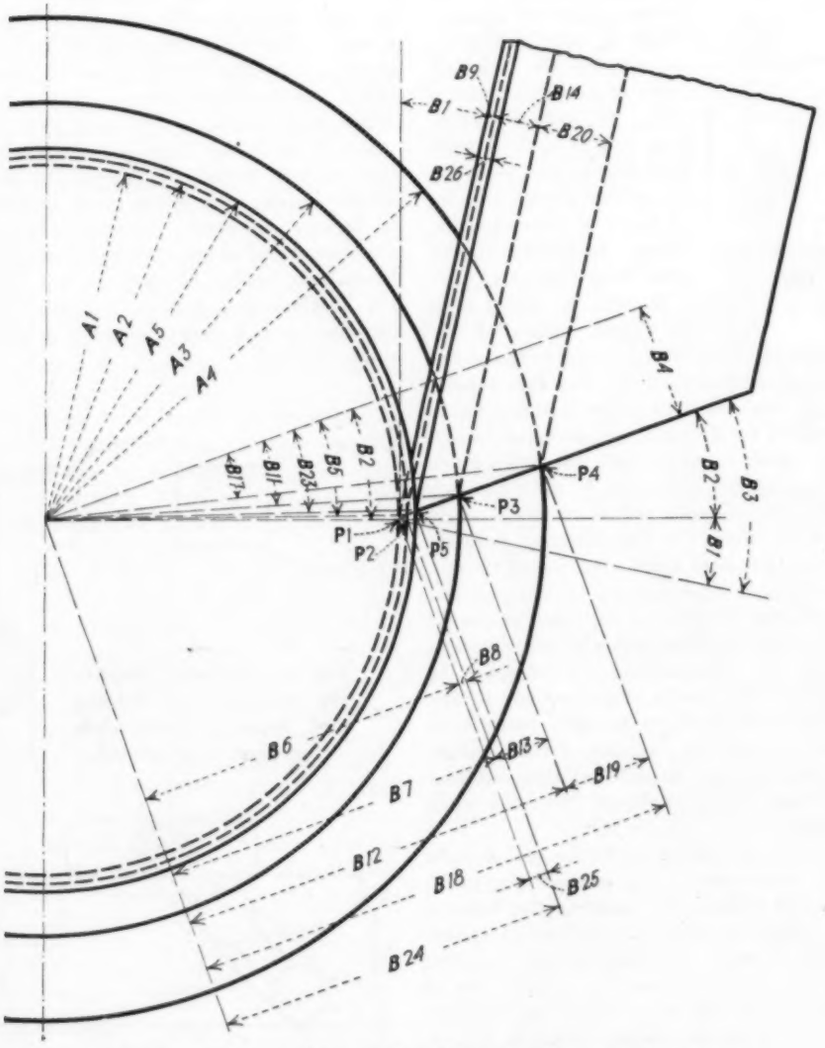


Fig. 20—Flat roughing tools with a simple top rake are designed according to Method 1, page 894

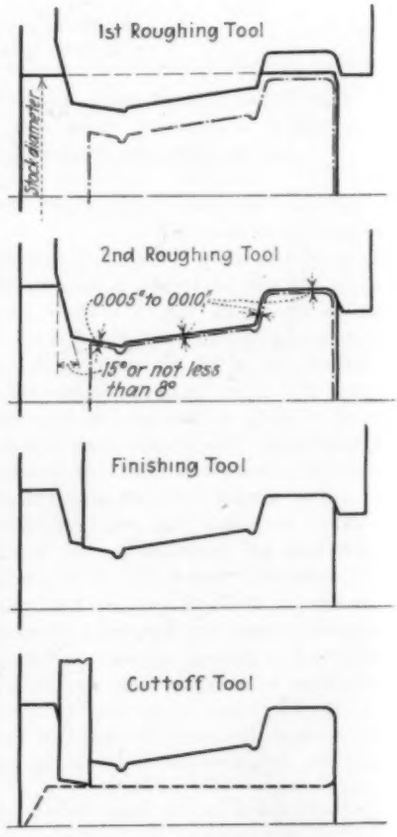
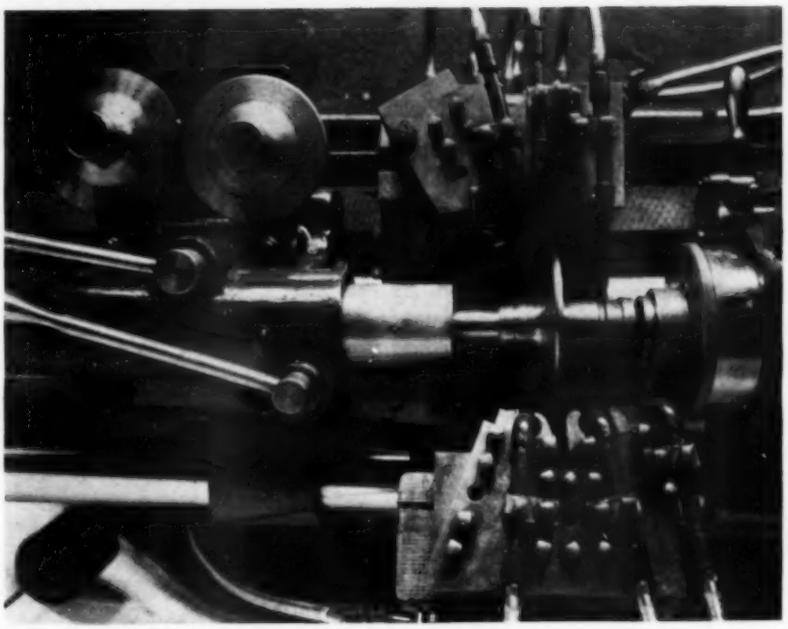


Fig. 19—On a 4-spindle automatic, using a first and second roughing tool, the stock will be removed in the proportion illustrated above

the extreme outside diameter of the stock to the smallest outside diameter of the finished product. See Fig. 19.

All flat roughing tools should feed radially. They are calculated in the same way as flat finishing tools, Methods 1 or 3 (see previous articles), depending on the requirements. Angle *B1* should be about 12 deg. for any kind of steel, and angle *B2* should be about 15 deg., although this will vary with the characteristics of the material cut. In Fig. 20 is shown a flat roughing tool in finished position, calculated as in Method 1 for a flat finishing tool (see Figs. 9 and 10, page 895). In Fig. 21 is shown a flat roughing tool in finished position, calculated as in Method 3 for a flat finishing tool (see Figs. 15, 16, and 17, pages 931 and 932).



A flat rough forming tool on one side and a flat finish forming tool on the other machine the outside of a steel automobile rear hub on a 14-in. Fay automatic

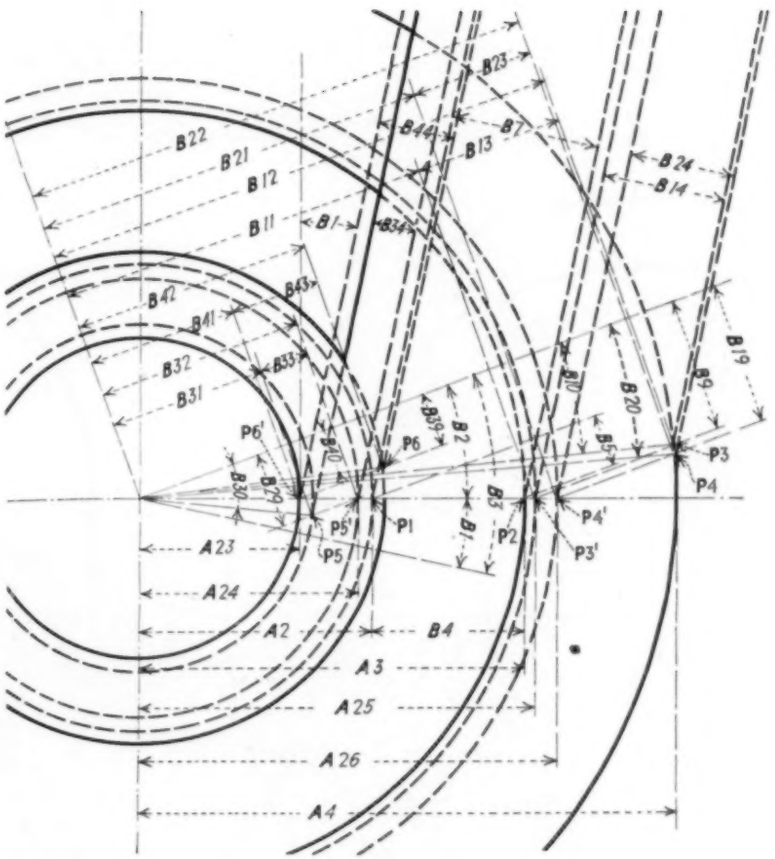


Fig. 21—Method 3 is used for a flat roughing tool in which points on the main cutting edge are kept on the center line of the product

Circular finishing tools and circular roughing tools should have the same clearance angles and the same rakes. Also the same procedure is used for calculating both types. We will calculate a circular roughing tool to form the part shown in Fig. 18. (See also Fig. 5, page 894.)

The rake angle is ground so the top surface of this tool is parallel to its axis; consequently only one point of the edge of the tool will cut on the center line of the work, and all the other points will cut below it. In Fig. 23 is shown an enlarged sketch of a circular forming tool in finished position, and in Fig. 22 is shown a layout of the tool profile. Angle *D14* should not be less than 5 deg. This angle may be increased considerably, depending largely on the shape of the product. This subject will be dealt with in a later chapter. Angle *D13* should be varied according to the steel to be machined. We will give *D13* a value of 20 deg., making a total of 25 deg. for *D15*.

$D13 + D14 = D15$

$D1 \times \sin D13 = D16$

$$\frac{D16}{D2} = \sin D17$$

$D2 \times \cos D17 = D18$

$D1 \times \cos D13 = D19$

$D20$ = radius of the tool at Point 1

$D20 \times \sin D15 = D21$

$2 \times D21 = D22$

$D20 \times \cos D15 = D23$

$D23 + D19 = D24$

$D24 - D18 = D25$

$$\frac{D21}{D25} = \tan D26$$

$$\frac{D25}{\cos D26} = D27$$

$$\frac{D16}{D5} = \sin D28$$

$D5 \times \cos D28 = D29$

$D24 - D29 = D30$

$$\frac{D21}{D30} = \tan D31$$

$$\frac{D30}{\cos D31} = D32$$

$$\frac{D16}{D3} = \sin D33$$

$D3 \times \cos D33 = D34$

$D24 - D34 = D35$

$$\frac{D21}{D35} = \tan D36$$

$$\frac{D35}{\cos D36} = D37$$

$$\frac{D16}{D4} = \sin D38$$

$D4 \times \cos D38 = D39$

$D24 - D39 = D40$

$$\frac{D21}{D40} = \tan D41$$

$$\frac{D40}{\cos D41} = D42$$

$D20 \times \sin D14 = D43$

$D27 - D37 = D44$

$$\frac{D44}{D7} = \tan D45$$

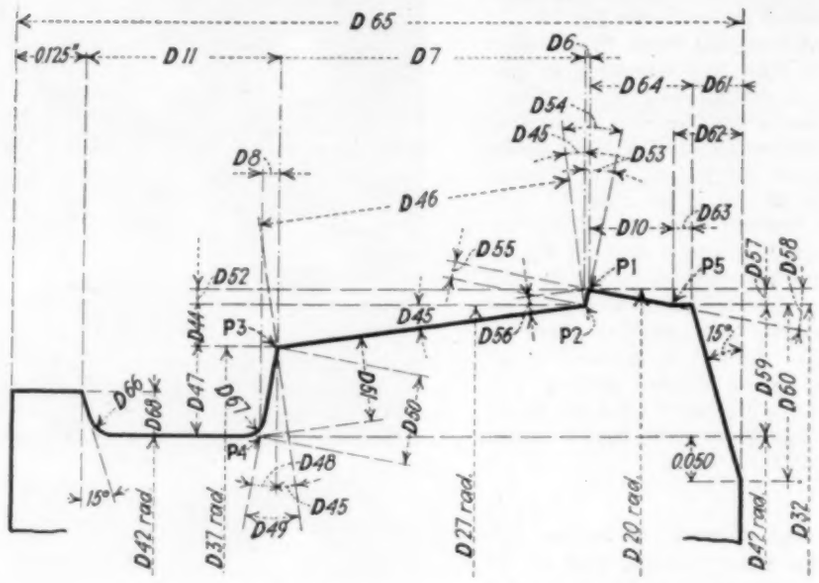
$$\frac{D7}{\cos D45} = D46$$

$D37 - D42 = D47$

$$\frac{D8}{D47} = \tan D48$$

$D48 + D45 = D49$

Fig. 22—For the product shown in Fig. 18, this profile is obtained for a circular roughing tool



$$\frac{D47}{\cos D48} = D50$$

$D50 \times \cos D49 = D51$

$D20 - D27 = D52$

$$\frac{D6}{D52} = \tan D53$$

$D53 + D45 = D54$

$$\frac{D52}{\cos D53} = D55$$

$D55 \times \cos D54 = D56$

$D20 - D32 = D57$

$$\frac{D57}{D10} = \tan D58$$

$D32 - D42 = D59$

$D59 + 0.050$ in. $= D60$

$D60 \times \tan 15$ deg. $= D61$

$D62 =$ thickness of cut-off blade

$D62 - D61 = D63$

$D63 + D10 = D64$

$D64 + D61 + D6 + D7 + D11 + 0.125$ in. $= D65$

$A22$ (See Fig. 3) $+ 0.008 = D66$

$A21$ (See Fig. 3) $+ 0.008 = D67$

$D68$ is the same as $B32$ (See Fig. 10)

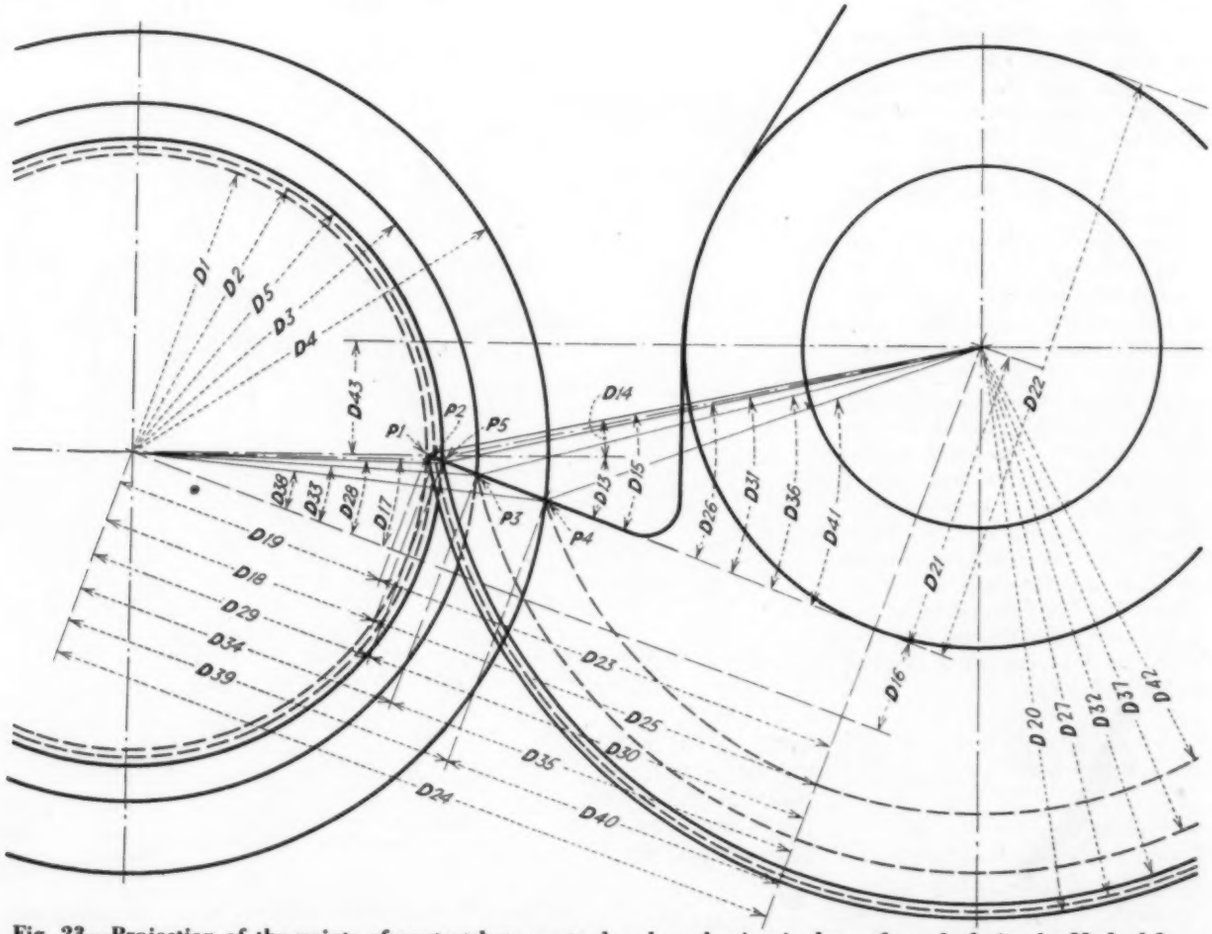
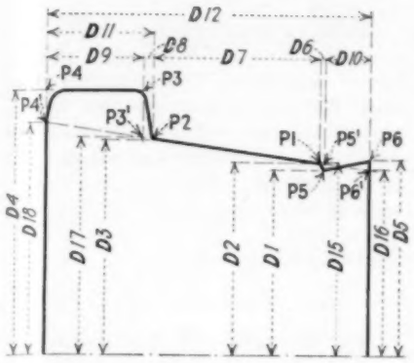


Fig. 23—Projection of the points of contact between tool and production is shown for calculation by Method 1

Fig. 24—The product here is the same as shown in Fig. 18 but the base line joining P1 and P2 has been extended



The ground surface of the 15-deg. tapered end of the tool is calculated to come at least 0.050 in. over the largest diameter. Dimension *D61* is not put on the work drawing, but is used merely for calculating *D65*, overall length of the tool. This is given as a fractional dimension on the working drawing.

As only one point of the tool shown in Fig. 23 cuts on center of the work and all other points cut below, the cutting edge will form a concave surface on the product between Points 1 and 2 (Fig. 24.) If it is important that this surface be straight, we will have to gash the tool at an angle with the tool axis so that Points 1 and 2 will both cut on the center line of the work, still maintaining the same rake angle. If we do this, the tool will cut better and last longer because this grinding gives it a shearing effect.

Fig. 24 is the product to be machined, Fig. 25 is an enlarged sketch of the tool in finished position and Fig. 26 is a layout of the tool profile. If Points 1 and 2 both cut on center of the product, we know that any point on a straight line drawn through Points 1 and 2 will also fall on the center line of the product after the tool has been gashed at the proper angle with the axis of the tool.

We will call this line, the base line, and this base line will be used for calculating any points that do not cut on center of the work. Draw lines from Points 3, 4, 5 and 6 perpendicular to the axis of the product, and where these lines intersect the base line, mark the new points 3', 4', 5' and 6'. The distance from these points to the center line of the product should then be calculated (see Fig. 24). In Fig. 25 and 26:

$D19 + D20 = D21$

$D22$ = radius of the tool at Point 1

$D22 \times \cos D20 = D23$

$D23 + D2 = D24$

$D3 - D2 = D25$

$D25 \times \sin D19 = D26$

$$\frac{D26}{D7} = \tan D27$$

$D27$ = vise angle

How to grind the rake angle on a tool having a vise angle, as well as an accurate way of checking the rake angle on a tool gashed straight across, will be illustrated in a later article.

$D24 - D3 = D28$

$D22 \times \sin D20 = D29$

$$\frac{D29}{D28} = \tan D30$$

$$\frac{D28}{\cos D30} = D31$$

$D17 \times \sin D19 = D32$

$$\frac{D32}{D4} = \sin D33$$

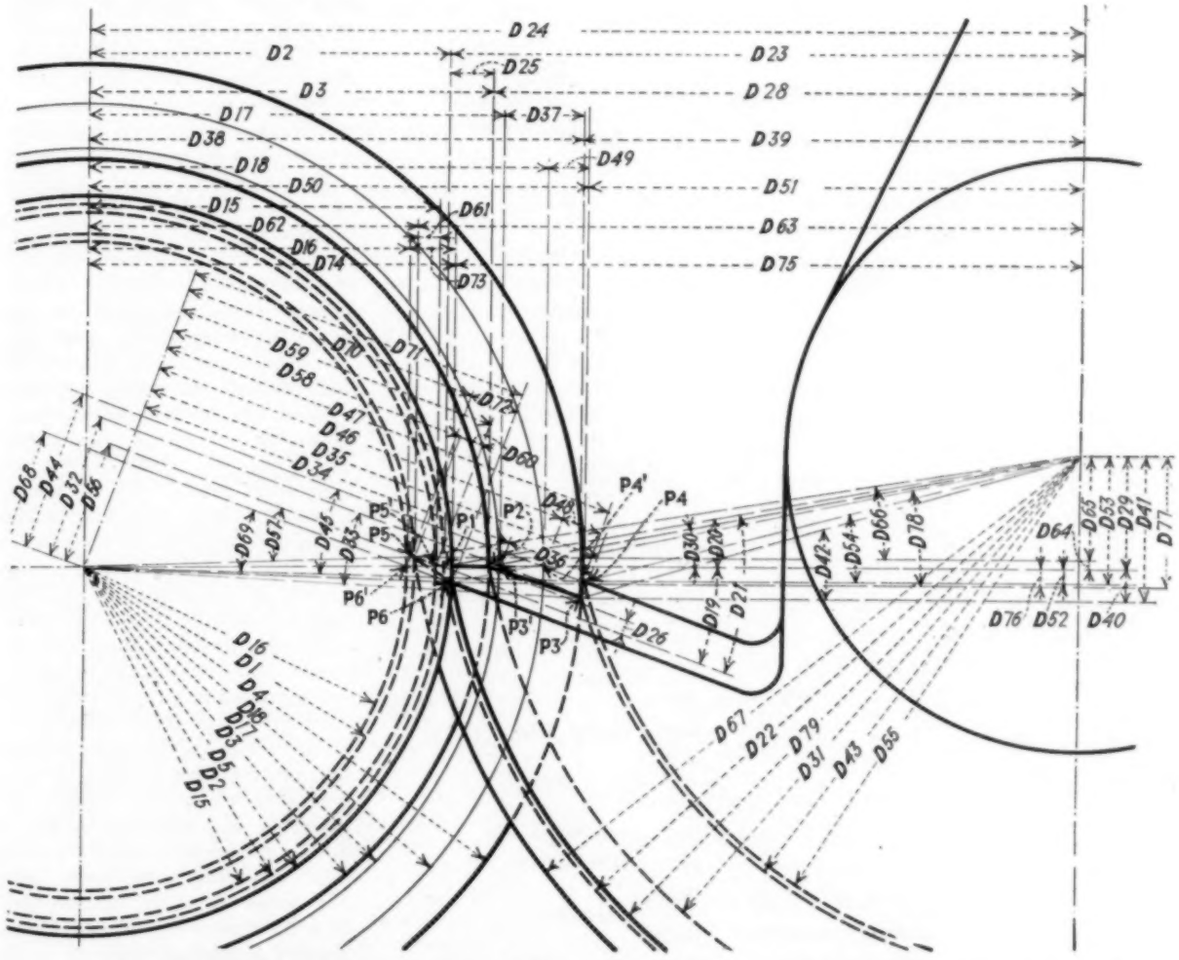
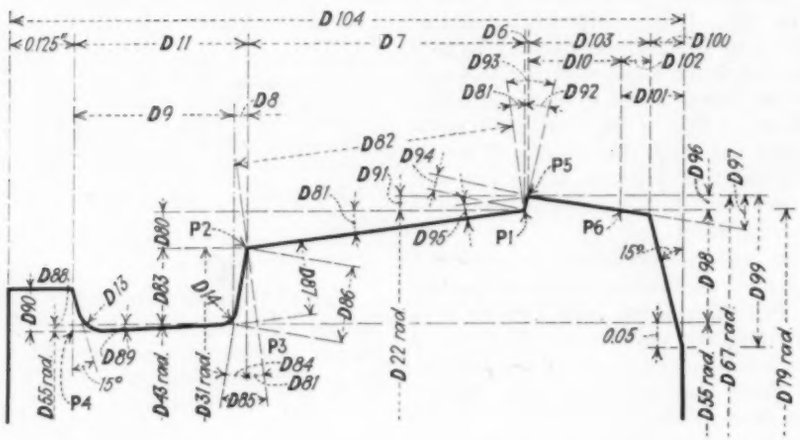


Fig. 25—Projection of the cutting points enables the calculation of a circular roughing tool by Method 3

Fig. 26—From the layout shown in Fig. 25, the tool contour shown below is obtained



$D17 \times \cos D19 = D34$
$D4 \times \cos D33 = D35$
$D35 - D34 = D36$
$D36 \times \cos D19 = D37$
$D37 + D17 = D38$
$D24 - D38 = D39$
$D36 \times \sin D19 = D40$
$D40 + D29 = D41$

$$\frac{D41}{D39} = \tan D42$$

$$\frac{D39}{\cos D42} = D43$$

$D18 \times \sin D19 = D44$

$$\frac{D44}{D4} = \sin D45$$

$D18 \times \cos D19 = D46$
$D4 \times \cos D45 = D47$
$D47 - D46 = D48$
$D48 \times \cos D19 = D49$
$D49 + D18 = D50$
$D24 - D50 = D51$
$D48 \times \sin D19 = D52$
$D52 + D29 = D53$

$$\frac{D53}{D51} = \tan D54$$

$$\frac{D51}{\cos D54} = D55$$

$D15 \times \sin D19 = D56$

$$\frac{D56}{D1} = \sin D57$$

$D1 \times \cos D57 = D58$
$D15 \times \cos D19 = D59$
$D59 - D58 = D60$
$D60 \times \cos D19 = D61$
$D15 - D61 = D62$
$D24 - D62 = D63$
$D60 \times \sin D19 = D64$
$D29 - D64 = D65$

$$\frac{D65}{D63} = \tan D66$$

$$\frac{D63}{\cos D66} = D67$$

$D16 \times \sin D19 = D68$

$$\frac{D68}{D5} = \sin D69$$

$D16 \times \cos D19 = D70$
$D5 \times \cos D69 = D71$
$D71 - D70 = D72$
$D72 \times \cos D19 = D73$
$D73 + D16 = D74$
$D24 - D74 = D75$
$D72 \times \sin D19 = D76$
$D76 + D29 = D77$

$$\frac{D77}{D75} = \tan D78$$

$$\frac{D75}{\cos D78} = D79$$

$D22 - D31 = D80$

$$\frac{D80}{D7} = \tan D81$$

$$\frac{D7}{\cos D81} = D82$$

$D31 - D43 = D83$

$$\frac{D8}{D83} = \tan D84$$

$D84 + D81 = D85$

$$\frac{D83}{\cos D84} = D86$$

$D86 \times \cos D85 = D87$
$D43 - D55 = D88$

$$\frac{D88}{D9} = \tan D89$$

$D90$ = same as $B32$ Fig. 10
$D67 - D22 = D91$

$$\frac{D6}{D91} = \tan D92$$

$D92 + D81 = D93$

$$\frac{D91}{\cos D92} = D94$$

$D94 \times \cos D93 = D95$
$D67 - D79 = D96$

$$\frac{D96}{D10} = \tan D97$$

$D79 - D55 = D98$
$D98 + 0.050$ in. $= D99$
$D99 \times \tan 15$ deg. $= D100$
$D101$ = thickness of cut-off blade
$D101 - D100 = D102$
$D102 + D10 = D103$
$D103 + D100 + D6 + D7 + D11 + 0.125$ in. $= D104$

Actual computations for a tool to cut a specified form should be made with the use of logarithms. Tables carried to at least five decimal places should be employed as these will give working tool dimensions accurate to four places. The application of logarithms to forming tools is given in Article I of this series (page 896).

In Defense of the Patent
Discussion

CHARLES H. FRANCIS

Contemplation of the new Patent Office building in Washington stirs mixed emotions, especially after a visit to a Patent Exhibition such as that recently held in New York. If the patents exhibited were a fair cross-section of those issued by the Patent Office, one might be justified in asking why a patent office is necessary and why patents are issued at all. Few of the patents shown will ever earn their cost. They run the gamut from folding airplane wings designed with no conception of the stresses to which a wing is subjected to "a new combination of gearing which counteracts the law of gravity."

The amount of money spent for patents that can never be of practical value is enormous. Add to this the fees of attorneys, who should know of their lack of value, and the total is almost staggering. Why not refuse to take the money for patents that appear valueless? The application could be recorded and thus reinvention would be prevented.

Then, too, we find patents that cover devices that were old when Methuselah was a pup but which no one ever attempted to patent. We can't blame the examiners for granting the patents, because the majority of them cannot be over middle age and could hardly have known of the old devices even had they been in the particular industry to which they belong. Why not publish a patent claim six months before the patent is granted to give old timers a chance to prove it is old if they can. The inventor loses nothing, for the application protects him as to priority, and if it is found to be an old idea, he at least saves the last payment on the patent. Such a plan would prevent law suits as many inventors unwittingly patent an old device in good faith. And some of us old timers may be saved from being accused of pirating patented devices that were old when we were boys.

EDITORIALS

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Taking the Aggressive

Out of the trenches at last. Unless all signs fail, the conference of the banking and industrial committees of the Federal Reserve Districts with federal officials held last Friday marks one more forward step in the aggressive move against deflation and defeatism. For two years and more we have been fighting a defensive battle against the forces of depression, much like the digging-in tactics of the first three years of the World War.

Since last March, however, there has been a growing feeling that the time for attacking in the open was approaching. We have now reached that stage. If you care to continue the symbolism of World War strategy you might say that we are now engaged in a Meuse-Argonne offensive against unemployment, or even that the Lausanne agreement corresponded with the Armistice, and that we are now marching into the conquered territory of the defeated pessimists. Possibly this last flight is a bit overoptimistic.

In attempting to appraise the value of last Friday's meeting one ought to have clearly in mind the consecutive steps in the Administration program. The best exposition of this program appeared in the *Business Week* for August 24, and we can do no better than review it here. These were the steps:

1. *Post-Stock-Market-Collapse Phase, November, 1929—June, 1930*
   - *a.* Reserve Credit expansion to protect call loans and release private investment funds
   - *b.* Continuance of construction and maintenance programs by railroads and utilities
   - *c.* Public construction and Farm Board support of commodity prices
   - *d.* Maintenance of wages.
2. *International-Financial-Panic Phase, June, 1930—June, 1932*
   - *a.* War debts and reparations moratorium
   - *b.* Federal Reserve Credits to Bank of England and Reichsbank
   - *c.* National Credit Corporation (To support banking structure.)
   - *d.* Reconstruction Finance Corporation (To support banking structure.)
   - *e.* Glass-Steagall Act (To offset foreign attacks on the dollar.)
   - *f.* New revenue measure and budget balancing (To offset foreign attacks on the dollar.)
3. *Credit-Expansion-and-Reconstruction Phase, March, 1932*
   - *a.* Open-market Federal Reserve operation
   - *b.* The bond pool
   - *c.* Emergency Relief and Construction and Home Loan Bank Acts
   - *d.* Organization and national coordination of banking and industrial committees in Reserve Districts
   - *e.* Support of commodity prices by pool financing of private purchases
   - *f.* Stimulation of employment in capital goods industries
   - *g.* War debt revision for foreign trade expansion
   - *h.* Revision of anti-trust laws.

This program is the most remarkable and in some respects the most daring economic proposal of modern times. Its success depends entirely on the measure of its ability to stimulate the individual citizen and business man to do his full share in reviving business, industry and employment. If he continues to hold back, to crouch in his trench, the whole effort will fail, and with failure will come hardship and suffering beyond anything we have yet experienced or even thought of. Don't expect, therefore, that Friday's meeting will do much to produce stimulation of employment in capital goods industries (Section 3f of the program), unless the people of this country are ready to take the aggressive boldly and to accept their individual responsibilities. We believe they are ready and eager to do so.

Balance Net Cost Against Labor Saving

Saving a few seconds or minutes gets to be such a fad with some engineers that they ignore net costs. Because of a wage rate that is normally higher than in other countries many have become accustomed to thinking of labor as presenting the main opportunity for economy.

But the pendulum is swinging in the opposite direction. An example is the abandonment of a most ingenious method of embossing designs on a screw machine product while the part was still in the machine. The results were satisfactory except for the total cost, which was higher than by the old method.

First cost and maintenance of the embossing mechanism was the deciding factor, although the additional machine time required played its part. This is one of the instances where we have stressed one cost factor while ignoring others that offset the advantage gained. Improved methods are always to be desired, but net costs must also be carefully considered.

Don't Blame the Production Man

Short-sighted financial heads of industrial companies have only their own lack of vision to blame for a situation that is unique. We refer to the unwillingness of production men to ask for the new equipment which they know is vitally needed, equipment that

would cut costs to the point where orders could be taken from competitors, equipment that would turn red ink into black.

Two years ago these men knew what they wanted and asked for it. They were met with a curt refusal to spend a cent for equipment. They had courage then. Some of them even went so far as to buy complete sets of parts for the machines they needed, charging them to the repair account.

But things are different now. Jobs are scarce. To court a rebuff from the boss is hardly the part of discretion.

So discretion has replaced courage, equipment is obsolete, production costs are exorbitant. Initiative may not be dead but it is certainly dormant. Don't blame the production man. Would you do otherwise in his place? But for the sake of your company rectify this situation before it is too late. Your competitors may have been more far-sighted.

• CHIPS •

President Hoover and his assistants meet with banking and industry committees to plan revival of capital goods industries . . . U. S. Steel announces intention of spending $5,000,000 for new equipment and plant maintenance . . . Remington Rand will buy $4,500,000 worth of raw materials and supplies . . . Federal Home Loan Discount Board members designate districts for regional banks . . . R.F.C. loans announced by meticulous clerk of the House . . . result generally negative . . . no consolation to the snoopers because no loan exceeded $5,000,000 . . . no apparent harm to public confidence because security markets took little notice . . . Sentiment continues to improve as commodities and bonds keep on upward and stocks hold their own . . . Commodities Finance Corporation organizes by electing M. N. Buckner president and C. A. McCain chairman of the executive committee.

Department of Labor reports some little improvement in employment . . . Figures vigorously disputed by group of engineers known as Technocracy . . . also by Miss Perkins, N. Y. State Industrial Commission . . . branded as propaganda . . . Census of Manufactures reports 1931 machine tool production valued at 80 millions, as compared with 244 millions for 1929 . . . drop of nearly 70 per cent . . . Number of companies decreased less than 2 per cent . . . Shipyards approach end of current orders . . . face shutdown unless new orders appear . . . A.F.L. thinks conditions are better, reversing its previous pessimistic opinion . . . joins with Advertising Club of New York in 7-point prosperity plan . . . advocates repeal of prohibition, 6-hour day, 5-day week, more public works, sales tax, lower government costs, change in anti-trust laws, cooperation between business and labor . . . coal miners strike in Indiana, farmers in Iowa.

Ottawa Conference brings forth 3-year, 5-year, 10-year agreements, pacts in principle, and understandings . . . Fails in some major objectives but bids fair to cost U. S. from $75,000,000 to $100,000,000 in trade . . . Another result is opening of trade accord negotiations between France and U. S., and possible French empire conference . . . Von Papen threatens to execute murderous Nazis . . . Hitler threatens to execute almost everybody else . . . worry over situation diverted by howls of nudists as Prussia prepares to drape them . . . Italy considers war loan conversion . . . Clouds thicken again in China as boycott and bombing increase tension.

Street railway traffic in July off 19 per cent from July, 1931 . . . *Chemical & Metallurgical Engineering's* weighted averages of chemical prices rose in August to 84.53 as against 84.33 in July, and 85.77 a year ago . . . prices of oils and fats to 43.41 as against 41.95 in July and 61.53 last summer . . . Operations in chemical manufacturing plants dropped off, however . . . Hoover Dam project a year ahead of schedule, even though Nevada complains about commissary and payroll methods of contractors . . . Although textile industry apparently passed its low point in May and June it is still far from sturdy . . . *Engineering News-Record* index of cost of important construction materials rises from 153.36 in July to 156.80 in August, contrary to usual seasonal trend . . . index of volume of construction rises from 131 in June to 166 in July, also contrary to seasonal trend . . . Consumption of electric energy increases slightly but not in plants of electrical manufacturers . . . Nonferrous metal prices were firm or advanced . . . sales also . . . lead sold well here, copper abroad and at prices above domestic, tariff or no tariff.

Borden announces successful installation of combination ice cream freezing, packing, package-making machine . . . may lead to replacement of large installations of ice cream machinery . . . Lack of buying courage holding up business in power plant equipment field . . . definitely marked trend toward installation of independent power plants to replace purchased power . . . municipal power plant expansion has kept several manufacturers going . . . Fageol brings out a twin-coach combination bus and rail car . . . small flanged wheels, retractable, keep car on rails . . . Night passenger air service now available between Chicago and New York . . . leave at midnight, arrive for breakfast . . . N.Y.C. and P.R.R. finally see daylight and cooperate to stop running some of their competing but almost empty through passenger trains. with profit to both.

A. W. ROBERTSON

MALCOLM MUIR

Robertson Heads Committee On Industrial Rehabilitation

As part of the program outlined at a meeting of 250 business and industrial leaders in Washington, Aug. 26 and 27, by Secretary Mills, six subcommittees were appointed to give immediate study of the specific proposals to stimulate economic recovery. An important part of the plan is the expansion of capital expenditures by industry in the way of replacement of obsolete and worn-out equipment, and otherwise. A. W. ROBERTSON, chairman of the board of the Westinghouse Electric & Mfg. Co., is chairman of the sub-committee of this phase of the nation-wide move to expand credit and spread employment.

Others who have accepted membership on this committee are:

E. T. WEIR, vice-chairman,
Chairman, National Steel Corp.

JOHN E. ZIMMERMAN,
Chairman, Rehabilitation Committee,
Third Federal Reserve District
President, Philadelphia Electric Co.

J. E. LEWIS,
President, Harbison-Walker Refractories Co.

H. S. WHERRETT,
President, Pittsburgh Plate Glass Co.

MALCOLM MUIR,
President, McGraw-Hill Publishing Co.

J. S. TRITLE,
Vice-President, Westinghouse Electric & Mfg. Co.

ROBERT F. PACK,
Chairman, Rehabilitation Committee,
Ninth Federal Reserve District
President, Northern States Power Co.

PHILLIP P. BLISS,
Chairman, Rehabilitation Committee,
Fourth Federal Reserve District
President, The Warner & Swasey Co.

F. J. Moss,
Chairman, Rehabilitation Committee,
Tenth Federal Reserve District
President, American Sash & Door Co.

In discussing basic reasons why business would be justified in spending money now for rehabilitation and modernization Mr. Robertson said: "Financial and credit affairs are clearly and positively better. In fact, it might well be said that whatever weaknesses there were in the financial situation have been corrected or are in the process of being cured. Improvement or alteration work done now would be helpful in many ways. It would help unemployment. It would cost less. It would interfere little with routine production."

He further pointed out that reserves of capital are available for the credit expansion required to finance such undertakings. All that is necessary is for business and industrial leaders to display the courage and confidence that will put the plan into a working reality. Mr. Robertson is also a member of the central committee headed by HENRY M. ROBINSON.

Other subcommittees named for parallel lines of activity are those for:

The problem of making available credit affirmatively useful to business—chairman, OWEN D. YOUNG.

Increased employment on railroads and stimulation of industry through expansion or maintenance of equipment and purchase of new equipment in cooperation with the Interstate Commerce Commission and the Reconstruction Finance Corporation — Committee, DANIEL WILLARD, president of the Baltimore & Ohio Railroad, and GEORGE H. HOUSTON, president of the Baldwin Locomotive Works.

Increasing employment through the sharing-work movement — chairman, WALTER C. TEAGLE, president of the Standard Oil Co. of New Jersey.

Stimulating repair and improvement

• INDUSTRIAL REVIEW •

Frank relief at the passing of the month of August is the general sentiment among machinery men. The feeling that September will be appreciably better persists, and has encouraged many to take brief vacations in preparation for anticipated activity.

Most of the big plants in Detroit are closed until after Labor Day. Pattern makers are busier, some of the better ones operating night shifts. A few have been told that a lot of business is just ahead and some of the tool shops have been led to expect orders in September. Considerable second-hand machinery has been disposed of in Indianapolis lately and dealers are expecting orders for new equipment soon. Employment has remained about stationary in Milwaukee but a better feeling prevails.

In Cleveland the prospect of new automobile models in September has led parts makers to expect some orders. Employment is up a little but the average rate has decreased somewhat. Bank deposits are growing and some people are buying securities, for cash. A Pittsburgh dealer reports getting a small order for machine tools, the first in a long time. In Boston more inquiries are coming in but orders are hesitant to follow. New York is doing practically nothing and looks for no more until September. Philadelphia reports a little business placed but nothing to cause excitement.

From St. Louis comes the statement that there has been no change in a fortnight. Cincinnati is in much the same situation but notices a pronounced change in sentiment. A small Russian order was placed. Chicago finds that everyone is hopeful but wants to be sure this improvement cry is not a false alarm before loosening up the purse strings.

of homes movement — Committee, SEWELL L. AVERY, president of Montgomery Ward & Co., and C. M. WOOLLEY, chairman of the American Radiator Co.

Organizing of committees in the several districts to assist house owners with maturing mortgages—chairman, CHARLES A. MILLER, president of the Reconstruction Finance Corporation.

Machine Tool Shipments Gain in July

For the first time in five months, machine tool shipments showed an increase over the previous month according to the July figures of the National Machine Tool Builders' Association. The July index of shipments showed a weighted average of 26.6 made up as follows: Index A (base more than $50,000), 25.1; Index B (base $10,000 to $50,000), 24.0; Index C (base less than $10,000), 68.3. This compares with a total index of shipments of 22.3 for June. As indicated by the breakdown, shipments from small companies are responsible for the rise. Unfilled orders remained at practically the same point as the previous month with a July index of 75.7 as against a June index of 75.8. By machine groups the figures for July were: Index A, 66.9; Index B, 103.0; Index C, 98.4.

The gross order index was 25.1 for July and 33.8 for the three months' average. The average is a decline from the figure for June of 39.1.

Census Shows 70 Per Cent Decrease in Machine Tools

Contrasting sharply with the boom year of 1929, the preliminary figures just released by the Bureau of Census for machine tool production in 1931 show a drop of 69.8 per cent. The dollar value for machine tools alone was $56,368,822 for 1931 as against $186,373,954 for 1929, the last preceding census year. The total value of products, which include replacement and repair parts, receipts for contract, repair work and other products, fell from $244,578,088 to $80,954,487 or 66.9 per cent in the two-year period.

A comparison of the 1920 and 1931 figures follows; those for 1931 are subject to revision. It will be noted that the Census Bureau has made these figures available earlier than ever before. The 1929 preliminary report was not released until October, 1930.

Summary of the Machine-Tool Industry, 1931 and 1929

	1931	1929	Per Cent of Decrease
Number of establishments	275	280	— 1.8
Wage earners (average for the year)	21,168	47,391	—55.3
Wages	$25,062,306	$76,410,237	—67.2
Cost of materials, fuel, and purchased electric energy	$22,110,356	$64,284,022	—65.6
Products, total value	$80,954,449	$244,578,088	—66.9
Machine tools	$54,865,487	$176,426,454	—68.9
Replacement and repair parts	$7,504,327	$17,150,306	—56.2
Other products, value, and receipts for contract and repair work	$18,584,635	$51,001,328	—63.6
Value added by manufacture	$58,844,093	$180,294,066	—67.4

Production of Machine Tools—By Class, Number and Value: 1931 and 1929

Class	1931 Number	1931 Value	1929 Number	1929 Value
Machine tools, total value	.....	$56,368,822	.....	[1]$186,373,954
Made in the machine-tools industry	.....	$54,865,487	.....	[1]$176,426,454
Made as secondary products in other industries	.....	1,503,335	.....	9,947,500
Bending machines	940	$458,253	2,680	$1,583,794
Boring machines:				
Horizontal	68	571,359	159	932,237
Vertical	16	223,614	257	1,363,881
Special types —				
Combination boring, drilling, and milling	45	492,298	144	1,467,786
Combination boring and turning	28	362,581	129	1,341,240
Other	(2)	264,788	(2)	[1]1,108,203
Cutting-off machines:				
Band-saw	82	49,971	324	194,098
Hack-saw	610	136,998	2,680	642,475
Other, including automatic and cold-saw	97	115,267	[3]181	[3]368,617
Drilling machines:				
Horizontal	(2)	742,227	274	755,997
Vertical —				
Multiple-spindle	238	943,309	1,003	4,149,614
Standard	(2)	639,468	3,315	2,022,870
Sensitive —				
Single-spindle	844	169,734	2,977	919,734
Multiple-spindle	175	210,769	2,404	2,453,444
Radial	204	630,609	1,317	4,643,310
Combination vertical and horizontal	29	225,890	.....	.....
Other special, including automatic, bench, and vertical universal-head	(2)	1,611,640	(2)	2,349,551
Honing machines	80	218,170	1176	1588,250
Forging machines	(2)	1,240,855	950	3,066,650
Gear-cutting machines	(2)	3,568,621	2,216	8,979,908
Grinding machines:				
Cutter and tool	346	351,023	2,187	1,574,966
Drill	59	30,739		
External cylindrical —				
Plain	425	2,085,484	1,362	6,206,709
Universal	57	140,728	603	1,173,912
Surface —				
Horizontal	187	341,677	1,790	3,567,658
Vertical	359	541,248		
Other, including disk, internal cylindrical, and wet grinders	(2)	4,758,437	(2)	19,578,682
Hammers (not portable)	(2)	665,148	(2)	1,594,996
Keyseaters	18	34,324	(2)	94,999
Lathes:				
Bench	(2)	110,797	(2)	381,240
Engine —				
General-utility —				
Capacity 16" swing and under	2,304	1,459,643	6,387	5,402,569
Capacity over 16" swing and including 22"	300	621,638	1,535	3,203,995
Capacity over 22" swing and including 36"	84	229,260	681	2,374,637
Heavy-duty — over 36" swing	19	317,401	90	778,269
Polishing and buffing	206	148,623	4,911	1,167,357
Automatic single-spindle —				
Bar	201	631,587	4,737	18,356,038
Chucking	253	702,902		
Automatic multiple-spindle —				
Bar	192	1,413,212		
Chucking	188	1,950,418		
Turret —				
Horizontal hand-operated —				
Ram type	219	474,999	3,132	9,878,132
Saddle type —				
Standard	110	508,519		
Heavy-duty	47	344,376		
Other — vertical, turret, gap, etc.	(2)	936,022	1,670	8,011,537
Milling machines:				
Hand-feed	87	41,488	312	129,803
Power-feed —				
Automatic	(2)	176,149	(4)	(4)
Plain	354	709,263	1,112	2,759,194
Universal	(2)	666,882	2,270	5,840,142
Vertical	168	616,398	469	1,428,516
Lincoln, including planer type	90	631,910	904	4,216,890
Other	(2)	914,668	600	2,482,024
Planers:				
Standard —				
36" and under	18	81,052	62	368,537
Over 36"	11	191,498	57	807,835
Open-side	14	102,434	89	873,105
Special	9	54,124	60	467,764
Pipe cutting and threading machines:				
Number reported	303	309,996	2,933	1,756,564
Number not reported	.....	204,372	.....	.....

Production of Machine Tools—By Class, Number and Value: 1931 and 1929—Continued

Class	1931 Number	1931 Value	1929 Number	1929 Value
Portable tools:				
Drills —				
Electric —				
Number reported	53,744	$2,437,787	114,306	$4,586,469
Number not reported	.....	54,882	.....	.....
Pneumatic	6,664	1,190,997	[1]19,063	[1]2,446,608
Grinders —				
Electric	10,207	539,698	46,360	2,395,279
Pneumatic	3,806	425,491	10,484	1,151,348
Hammers (chipping, riveting calking, etc.)—				
Electric	(2)	119,442	3,739	648,671
Pneumatic	12,011	1,112,099	[1]51,391	[1]2,900,224
Other, including portable motor-driven garage equipment and flexible-shaft machines	.....	5,606,157	(2)	[1]5,638,575
Presses:				
Forming	145	407,431	609	1,756,371
Hydraulic	6	15,281		
Stamping, power	(2)	1,392,635	4,352	6,611,169
Punch	351	294,914	1,638	1,004,324
Other, including arbor, and hand and foot power stamping presses	(2)	274,069	(2)	420,327
Punching machines (not portable)	35	159,382	330	1,111,993
Riveting machines (not portable)	(2)	257,695	(6)	(6)
Shapers, horizontal:				
20" stroke and under	119	191,795	1,044	1,441,239
Over 20" stroke and including 28"	83	160,610	442	855,872
Over 28" stroke	23	91,331	191	506,994
Shears, hand	171	9,977	797	22,696
Shears, power:				
Combination punch and shear	(2)	185,021	488	501,808
Rotary	194	122,349	550	193,591
Straight	199	239,444	753	991,496
Other, including alligator	(2)	65,355	(2)	431,800
Slotters and vertical shapers	105	342,523	292	782,198
Threading machines (except for pipe):				
Die and rolling type	394	436,408	861	1,508,166
Milling type	122	473,005	150	680,432
Tapping machines	(2)	126,800	(2)	603,180
Other machine tools and machine tools not districuted by kind	.....	3,261,384	.....	[1]13,775,393

NOTE:—
[1]Revised.
[2]Data incomplete.
[3]Cold-saw only.
[4]Not called for separately on schedule.
[5]Not strictly comparable with figures for 1931; includes data for rock drills, tampers, etc.
[6]No comparable data.

7-Point Industrial Plan Proposed

In a meeting on August 24, the Advertising Club of New York announced a program of economic recovery by the concerted action of industry, commerce and labor. Part of the proposal is to call a national congress of capital and labor in October to devise ways and means of putting the plan into effect.

The "Seven Point Plan of Action" includes the following:

1. Unification of capital and labor in establishing security of employment and business stability.

2. Revision of anti-trust laws to permit greater cooperation and to balance production and consumption.

3. Coping with unemployment by the adoption where possible of the six-hour day and five-day week.

4. An aggressive program of Federal, State and Municipal public and semi-public works, these to be self-liquidating insofar as possible. This program would be financed by a four billion dollar bond issue and would provide employment for a million men.

5. A broadening of the base of taxation in the form of general sales tax which would be borne by the ultimate consumer.

6. Elimination of overlapping governmental activities to reduce the cost of Federal, State and Municipal government.

7. Abolishment of prohibition and the immediate liberalization of the Volstead Act as a means of securing additional employment and of raising revenue for the government.

These points have the approval of the American Federation of Labor, the Advertising Federation of America and the Association of National Advertisers.

Standard Punch and Die Sets

The proposed American Standard for Punch and Die Sets has been released to industry for criticism and comment. The proposal covers a range of sizes in five different styles. Detailed dimensions of the die sets proper, guide-post lengths, bushing dimensions, the design and dimensions of the holding clamps are included. Copies may be secured from C. B. LePage, assistant secretary, American Society of Mechanical Engineers, 29 West 39th St., New York, N. Y.

Forged Tools Standard Unchanged

According to an announcement by Edwin W. Ely, chief, division of simplified practice, Department of Commerce, the Simplified Practice Recommendation No. 17 on forged tools has been reaffirmed by the standing committee without change. The unanimous action was taken in light of the committee's knowledge of current conditions in the industry.

Exports of Machinery During July, 1932

	July, 1932	June, 1932	July, 1931
Power generating machinery except electric and automotive	$357,288	$314,593	$858,409
Construction machinery	339,482	325,793	1,188,245
Mining, well and pumping equipment	1,210,921	792,906	2,556,810
Power-driven, metal-working machinery	604,123	834,352	2,491,997
Other metal-working machinery	109,090	163,418	285,967
Textile machinery	346,901	293,002	488,815

Exports of Metal-Working Machinery During July, 1932

	July, 1932	June, 1932	July, 1931
Engine lathes	$59,023	$61,185	$198,539
Turret lathes	560	4,750	23,727
Other lathes	48,439	5,688	66,573
Vertical boring mills and chucking machines	7,494	102,562	77,646
Thread cutting, automatic screw machines	898	12,001	75,731
Knee and column type milling machines	16,234	30,083	75,956
Other milling machines	2,996	9,470	127,529
Gear cutting machines	23,525	29,526	191,906
Vertical drilling machines	2,283	3,474	69,573
Radial drilling machines	17,330	7,028	20,348
Other drilling machines	9,557	7,837	52,246
Planers and shapers	6,438	30,350	100,410
Surface grinding machines	16,836	2,611	37,514
External cylinder grinding machines	7,483	12,386	53,715
Internal grinding machines	12,191	26,840	141,807
Tool grinding, cutter grinding and universal grinding machines	11,257	28,865	59,340
Other metal-grinding machines	16,035	38,085	42,856
Sheet and plate metal-working machines	128,992	151,124	188,147
Forging machinery	61,668	86,707	353,916
Rolling-mill machinery	9,247	13,758	59,930
Foundry and molding equipment	29,087	51,357	124,023
Other power-driven metal-working machinery and parts	115,822	118,665	350,564
Related Exports			
Pneumatic portable tools	15,396	35,335	64,363
Machine-operated pipe and thread cutters, stocks, dies, taps and other machine-operated cutting tools	45,308	87,300	73,526
Other metal-working machinery	22,371	16,367	85,763

• BUSINESS ITEMS •

Aluminum Industries, Inc. has leased the plant formerly occupied at Cincinnati by the C. R. Breuer Smelting & Refining Co., and will move its motor parts division from St. Cloud, although the latter plant will not be closed entirely, according to HARRY J. HATER, general manager. The Cincinnati plant is equipped for foundry work.

Recently the C. I. Packer Tool & Die Co., Meriden, Conn., changed its corporate name to The Packer Machine Co.

Appointment of the Wiley-Hughes Supply Co., Trenton, N. J. as distributor for Detrolined bushing stock by the Detroit Seamless Steel Tubes Co. has been announced by C. H. HOBBS, president.

An office has been opened at 2168 West 100th St., Cleveland by GEORGE D. MILLER, formerly with WILLIAM K. STAMETS, and Mr. Miller will handle several lines of machine tools.

The Machinery & Welder Corp., formerly at 2406 North Cicero Ave., Chicago, moved recently to new and larger quarters at 316 North Sheldon St. The company acts as distributor for the General Electric line of arc welding equipment and distributors for the power transmission equipment manufactured by the Medart Co.

The Foote Bros. Gear & Machine Co., Chicago, has appointed the Urquhart Service, 2133 Blake St., Denver, Colo., as representative for its line of speed reducers and gears in Colorado and Wyoming.

Leland-Gifford Co., Worcester, Mass., has recently taken over the sale of die sets and die makers supplies made by the Gullberg Sales & Manufacturing Co., Inc., Detroit, Mich., in its Boston, Worcester, New York, Rochester and Chicago districts.

The International Engineering Service, Detroit, Mich., has established a cooperative export promotion division, to give smaller and medium sized manufacturers, who are contemplating entering the foreign field, representation and distributing services without involving great expenditure. The service is offered particularly to manufacturers of automotive parts, machine and small tools, jigs and fixtures, factory and shop equipment.

The New Method Stove Co., Mansfield, Ohio, and Columbus Stoker & Equipment Co., Columbus, have been merged and the plant of the latter will be moved to Mansfield. C. H. WOLFE, president of the Columbus firm will become chief engineer of the stoker company division.

Gardner Tap & Die Co., Marion, Ohio, has been purchased by B. A. SMALL of Sharon, Pa. and the plant at Marion will be dismantled and the equipment installed in the former plant of the American Steel Foundries Co., Sharon.

• PERSONALS •

B. C. SELHEIMER, factory manager of the Racine (Wis.) plant of the Massey-Harris Co., Ltd., Toronto, has been promoted to factory manager in charge of all manufacturing in the United States.

F. J. WINTERER has been appointed superintendent of production of the Shaw-Box Crane & Hoist Co., according to an announcement of Manning, Maxwell & Moore, Inc. G. A. MITCHELL is now proposal engineer, and C. H. SCHRAMM is designing engineer.

CHARLES EISLER, president of the Eisler Electric Corp., Newark, N. J., manufacturer of lamp machinery and electric welding machines, sailed for Europe on August 30 on the S. S. *Bremen* to study conditions in numerous European countries, including Russia.

WALTER GEIST, assistant manager of the milling machinery department, including the Texrope drive division, of the Allis-Chalmers Mfg. Co., will sail for Europe on September 9 to spend three months in the study of conditions on the Continent and the British Isles and to visit the company's manufacturing and sales organizations.

RALPH P. LAPORTE, formerly a member of the executive staff of the Edward G. Budd Mfg. Co., Philadelphia, has been appointed manager of manufacturing by the International Heater Co., Utica, N. Y.

J. W. SPEER, formerly manager, machinery electrification, industrial department, Westinghouse Electric & Mfg. Co., has been appointed manager of the commercial air conditioning products of the company. W. C. GOODWIN has been appointed division engineer of the air conditioning equipment division, coming to that position from manager of renewal parts, engineering department.

JULIUS F. STONE, SR., was elected president of the Case Crane & Kilbourne Jacobs Co., Columbus, recently. Mr. Stone is also president of the Columbus-McKinnon Chain Corp. and the Chisholm-More Hoist Corp., both of Tonawanda, N. Y. H. C. HOEFLICH has been elected vice-president and sales manager.

CHARLES H. WILLEY, well-known to readers of *American Machinist* for his many contributions to the "Ideas from Practical Men" department, was awarded the Congressional Medal of Honor at the Portsmouth, N. H., Navy Yard, August 18, for heroism on the cruiser *Memphis* when it was struck by a hurricane at Santo Domingo in 1916. At the time Mr. Willey was warrent machinist and saved the lives of the men trapped in a room filled with live steam from burst pipes. His injuries were so great that he was retired.

• OBITUARIES •

WILLIAM F. CAMERON, 68, president of the Frost Mfg. Co., Galesburg, Ill., until four years ago, died recently.

F. L. CLEVELAND, 69, formerly president of the Erie Engine Co., Erie, Pa., died suddenly, August 19.

RICHARD H. GARVER, 70, died at Union City, Ohio, August 19. He had been president of the Garver Machine Co. since its organization 10 years ago.

B. W. HOPKINS, president of the Sterling Stove Co., Portsmouth, Ohio, died recently. He was 63 years old.

SAM A. PERKINS, 69, one of the founders of the Waukesha Motor Co., Waukesha, Wis.. died recently.

• MEETINGS •

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. National Machine Shop, Practice Meeting, Buffalo. Week of Oct. 3. Calvin W. Rice, secretary, 29 W. 39th St., New York, N. Y.

NATIONAL METAL CONGRESS & EXPOSITION. 174th Regiment Armory, Buffalo, N. Y., Oct. 3-7. Sponsored By A.S.S.T., with cooperation of A.S.M.E., Institute of Metals and Iron & Steel Divisions of A.I.M.E., A.W.S., S.A.E., and the Wire Association. W. H. Eisenmann, 7016 Euclid Ave., Cleveland, Director.

NATIONAL SAFETY COUNCIL. Twenty-first annual safety congress, Washington, D. C., Oct. 3-7. National Safety Council, Civic Opera Bldg., 20 North Wacker Drive, Chicago.

Divided Responsibility

"Hello, Al, mighty glad to see you. Where's Mason? I thought you were going to bring him in today?"

"I did intend to, but he had to stay down at the shop and nurse a compressor."

"Trouble?"

"Yeah, a little. It's our first sale, and as it was a little one, we rigged up and made it ourselves. Of course, it had to be for ammonia, the hardest application there is."

"What seems to be the trouble, don't it work?"

"Not very good. It will compress up to 30 lb. all right, and then she blows. We know it isn't a leak, because we tried it on vacuum and it pulled 29 in., but the minute we try to get over 30 lb. pressure, there's nothing doing."

"What's the answer?"

"I don't know, but Mason probably does. That's the trouble with those rotary compressors. They're darn simple, but if anything goes wrong you don't know what it is. In a reciprocating compressor, you can set out the packing and adjust the valves and you know it's got to be right. With a rotary, nothing looks wrong, but the darned thing won't compress."

"What can you do about it, throw it away and build a new one?"

"No. We'll find the trouble after awhile. You remember when the automobile was new? When the cussed thing broke down, we were helpless. The only thing we could do was to take it all apart, put it together again and pray that it would go when we finished. Usually, it did, too. With a steam automobile, you knew what was wrong."

"Yeah, I remember, one took a day to find the trouble and five minutes to fix it, and the other took five minutes to find the trouble and a day to fix it. Those were the days of real sport."

"Well, the rotary compressor and the turbine are just like the gas car used to be. Sometimes a turbine will not get up to speed, and you puzzle your brains until you find some little defect in angle of blades or nozzles. Well, a rotary is the same way."

"Is that the only order you have received?"

"Yes, and about four more machines depend upon it."

"I thought you were going to have them built outside."

"We are, but this is a small one and we thought we'd build it ourselves. We did send the frame to the Tucker people to have it bored and faced. For awhile we'll continue to do that with the small ones. We can machine all the parts except the frame in our own shop."

"Isn't that the cause of your trouble? Did we ever have anything made outside that fitted parts we made ourselves? You know we had more headaches with that than with anything we ever tried. I am surprised at your doing it of your own free will."

"I don't think it is that, Ed. It's only one piece."

"Yes, but it's the most important piece. The one that holds and aligns all the others. I don't care if it does measure all right, it can still be out of line. Wouldn't that cause the trouble you're having?"

"It might, and of course I know that gages don't mean a thing. You can measure half a dozen different shapes, and they will all fit a two-point gage at every point; but I don't believe that is the trouble."

"No, of course you don't, but if you had let Tucker make the whole thing, assemble it and test it, it would have been right, or you wouldn't have accepted it. You're off on the wrong foot, I'm afraid, Al."

Is it good policy to let out part of an accurate machine? Would it have been better to have let the whole job and hold Tucker responsible?

In Our Own Shop or Outside?

It is usually the safest bet for a new firm to start off on a small scale. The product marketed by the new firm is most always subject to change in design.

If both manufacturing and experimenting are attempted in the small plant, there would be a tendency to break up machinery set-ups for manufacturing to do experimental work because of lack of equipment. This practice would interfere with prompt deliveries to customers which is a great asset to small new plants.

Careful inquiries to larger organizations usually reveal that manufacturing can be done at fairly reasonable cost, because their plants have an ample amount of idle machinery which can be "harnessed" to do outside jobbing. Experimenting and engineering costs are most generally much higher than manufacturing. Therefore, I believe it would be most logical to utilize the space of the new plant for experimenting, engineering and assembling.

—Peter L. Budwitz.

Cutting Loose

Is Al justified in looking to his old firm for work? The answer to that is more questions, such as—Has Al's work always been of the best quality? Has his honesty ever been questioned? Has his ability to do this type of work ever shown any weaknesses?

If these questions can be answered to

Al's credit and providing his price is as good as the other fellow's, the company should do business with him. It would injure itself by not doing so and show a sulky disposition that would do it no good with the trade. I admire Al's stand on the question of taking Williams into the firm, and then buying from him or looking to him for work. No matter how honorable a deal may be, there are always those who "smell a rat," and although they may be in the minority, talk of that kind cannot be a help to Al and his partners, nor to Williams and his employer. If Al wants Williams with him, then Williams should break away and join him; otherwise things should be carried on in a strictly business-like manner where there are no interlocking interests. —CHAS. R. WHITEHOUSE,
Standards Engineer,
The Holtzer-Cabot Electric Company.

Cutting Loose

"Let your conscience be your guide" is a good rule if you have the right kind of a conscience, but is a worthless rule if your conscience is not in good working order.

If Williams never knew before, he does know now that he will be treated squarely if and when he has any business dealings with Al. A conscience is usually consistent, and Al has shown that his is in good condition. —C. A. JOHNSON.

No Admittance

I have run against many manufacturers who refused to give or sell me photographs or other material to be published in the technical press, thinking they would loose some secrecy. In many cases I could have told such manufacturers that they were not using the best methods. How can they keep anything

secret in the long run, if workers and executives go from place to place selling their work? Is it not possible that some one of them, knowing the secret of a process will make an improvement and then go to somebody else?

According to my idea Bill Holland is right when claiming that nine out of ten secret processes are inferior to accepted practice. But the tenth one may for some time have a certain value. This process however is probably a small item in the manufacture of the article or articles where it is used. Then the secrecy of the process does not have much influence on the selling price of the article, and is therefore not so important. Any executive, claiming to have some secret process that he wants to keep for himself, might be eager to find out how the other fellow is doing his work. This I don't think is fair at all. Anyone who wants to keep processes for himself should also keep his hands off the methods used by other manufacturers.

As far as heat-treatment is concerned, I do not think there are any secret processes, because the steel manufacturers know pretty well how steel should be heat-treated and are glad to tell you if you don't know.

I am a believer in the open door conference for the exchange of ideas pertaining to all kinds of manufacture, and I think this is the only way by which efficient methods, secret or otherwise, may be kept up to date. —A. E. FRISTEDT.
Stockholm, Sweden.

Too Much Imagination

That word "imagination" is the keynote to this entire situation. As a man thinketh, so is he. Someone has declared that thought is the mainspring of action. This is a true, but there are various realms of thought. There is a class of men, of whom Mason is evidently one, who center their entire thought upon their work, and matters relative thereto. They cannot escape from this. And a man who is tied into a situation where his mind has long since "sucked all the juice from the orange" is in a bad way, and would be better off to move on. Even the things he has learned become distasteful to him, because they have led him up a blind alley.

There are other men who find it hard, seemingly, to dig into the details of their job, or to attempt any thorough understanding of it. Who is not acquainted with the visionary whose mind is continually wandering to distant pastures of various kinds. Even as he methodically rigs his lathe for the next job, he is mentally off on a trip to the coast, or perchance figuring out a line of snappy repartee to pull on Jim Jones at the lunch-hour session. At this, more often than not, he is really clever. For "as a man thinketh——". To such a man, there is nothing cruel about a repetitive job. But a job embodying variety would force him to leave his beloved sphere of thought, and would be proportionally distasteful. After all, it is well that there are two kinds of jobs. The problem lies in analyzing the job and the man, and in fitting the one to the other.
—JOHN E. HYLER.

The Up Grade

Few men possess every requirement for a job. If one on the spot has mingled successfully in the shops, has the faculty of getting on well with men, and in addition, possesses technical training, he is ideal for the post. Other things being equal, the more educated the better, not merely as an asset but as an essential.

The position of foreman is different—energy, tact, and craftsmanship will

carry him through, even though he feels the lack of technical knowledge. Put such a one assistant superintendent, and he will be as a fish out of water. The post in question requires a higher type of man and of education. Instructing in practical details is not his particular duty, but rather to organize shops as a whole, which require different qualities.

Men, having grown up with a firm, are sometimes promoted to the position of superintendent, even though not technical, and they fill the position well, having everything at their finger ends. Knowledge they lack is forthcoming from other sources; consequently, they carry on. But the most successful I have known have been technical rather than practical. —WILLIAM BRYCE,
Sheffield, England.

Till It Hurts

The President of a company may manipulate the methods by which the worker earns his pay, he may even fix the rate of pay, within limits, but he cannot govern the mode by which that money is spent.

The head of a firm is not experienced in the buying capacity of a worker's pay at the present time, nor is he acquainted with the requirements of the worker and his dependents, so that his qualification for the job he is assuming is nil. Surely it is most fortunate that an action of this kind is illegal.

In England, where the worker assists the workless by his national insurance against unemployment, it is true that many of the unemployed have a larger income, relative to the number of persons dependent upon them, than that enjoyed by those employed.
—D. Q. DUNSTON,
Durham, England.

American Machinist
Reference Book Sheet

Cleaning Aluminum

REMOVAL of oil, grease and fat from aluminum and aluminum alloys requires the use of a cleaning solution that does not attack or blacken these metals. Aluminum is readily attacked by free alkali and can be entirely dissolved in strong alkali solutions. The types of cleaning solutions used for the removal of oil, grease and fat from aluminum are: (1) Volatile solvents such as gasoline, naphtha, kerosene, carbon tetrachloride, and triethylchlorine; (2) water solutions of soap and alkali of a mild nature; (3) "water-soluble controlled alkali" solutions.

Volatile solvents are effective when clean, but become contaminated by the material removed, and they increase in viscosity and become less effective in direct proportion to the amount of material taken up. The cost of volatile solvents is very often prohibitive, and the fire hazard of several makes some of them undesirable for industrial use.

Water solutions of soap and alkali are sometimes not entirely successful because of the danger of attacking aluminum too much if the concentration is not accurately controlled. These soaps and alkalies in solution increase in free alkali in proportion to concentration. Usually, if the concentration is kept below the point of attack on aluminum, the cleaning efficiency is greatly impaired.

Water-soluble controlled alkali cleaners may be operated at any concentration, it is claimed, without danger of injuring aluminum or aluminum alloys. It is said that with concentrations as low as 4 oz. per gallon of water, heavy dirt accumulations are quickly removed. One type is suitable for the removal of vegetable oils, animal oils, animal fat and butter fat; in other words, for removing all oils that must be saponified. Another type is recommended for the removal of mineral oil or compounds which must be emulsified.

Some cleaners that do not mar the luster of aluminum are very slow, and it is therefore more efficient in some cases to use a cleaner that will attack aluminum slightly. If the metal is to be plated subsequently, a slight attack to roughen the surface is necessary, even when plating on a "smooth" surface is desired. Such cleaners are intermediate in action between many commercial cleaners for aluminum and those for other metals. The "gassing" resulting removes grease in the same way that electric cleaning does, and the metal surface is whitened slightly. Formula for such a cleaner, as recommended by the Aluminum Co. of America, is as follows:

Sodium carbonate (Na_2CO_3)
1 to 3 oz. per gal.
Trisodium phosphate (Na_3PO_4)
1 to 3 oz. per gal.

This cleaner is used hot at 180 to 200 deg. F., and is followed by a cold rinse. It is advisable to follow the alkaline cleaning with an acid dip, using 5 per cent hydroflouric acid solution—one part acid to nine parts water, and finish with a cold rinse. If the article is to be nickel plated the time of dipping will be 15 seconds; if zinc plated, 60 seconds.

Care must be exercised in handling the aluminum parts in tank cleaning. The following instructions must be followed if good results are to be obtained. (1) The entire piece of aluminum must be immersed in the solution, since discoloration may show at the water line if the work extends out of the cleaning solution; (2) The cleaning solution should never be allowed to dry on the work. The work should be rinsed immediately. Discoloration and attack quickly occur under atmospheric conditions, when a chemically cleaned surface of aluminum coated with a film of cleaning solution is allowed to air dry; (3) Rinsing of aluminum must be done with extreme care to prevent water spotting. If two rinses are available, the first rinse should be hot and the second or final rinse should be cold. If only one is available a cold rinse is indicated. Mineral salts in water, if quickly dried on an aluminum surface, are sufficiently strong in alkali to etch the surface. If the work is hot rinsed and allowed to air dry, spotting occurs at the final point of evaporation.

Mat Finish

A mat finish on aluminum is lusterless or dull and is produced by attacking or dissolving the exterior surface in a strong alkali. The desired finish is white in appearance or frosted. A definite recommendation for a cleaner to produce a mat finish is not possible because it depends entirely on the analysis of the aluminum. Tests with commercial cleaning materials will be necessary to develop the necessary concentration in order to produce a satisfactory mat finish. The result is entirely governed by the amount of iron and copper ore left in the aluminum after its refining. Unless careful tests are made in advance, the result may be either a white finish, or a black smudgy surface.

Bright Dip

A bright finish on aluminum differs from a mat finish in that it is artificially white in appearance. It is produced by a combination of acids in place of alkali. The following formulas have been used:

FORMULA NO. 1

Nitric acid	5 gal.
Hydrofluoric acid	1 gal.
Sulphuric acid	1 qt.

FORMULA NO. 2

Nitric acid	8 parts
Hydrofluoric acid	1 part

It is important that the aluminum surface be absolutely clean.

Courtesy of E. F. Houghton & Company and the Aluminum Company of America

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Recorder Pens—

A Problem in Drawing and Forming

WALTER C. SCHMIDT
Tool Engineer,
Brown Instrument Company

INDUSTRY'S products are expected to be troubleproof and enduring. It is inevitable, therefore, that industry should expect products manufactured for its own use to be even better and more long-lived, particularly those instruments and controls which record and govern the manufacture of consumer goods. Care and precision are prime factors in the construction of Brown recording instruments such as those used in modern installations to control heat-treating processes and to record flow and pressure. These instruments must control and indicate temperatures and record flow of liquids; their parts must, therefore, be made with precision and inspected with care.

Examples of highly accurate manufacturing have been given in a previous article (*AM*—Vol. 76, page 777). This one describes the manufacture of instrument parts which must be almost as accurate, and must in addition be drawn and formed so that water cannot pass the joints, and in materials that will resist corrosion from water and ink. These parts are recording instrument fountain pens, at first glance a simple stamping and forming job, but actually carefully manufactured parts designed to give trouble-free service for years.

Recorder pens are commonly attached to the recorder arm by soldering. This insures exact positioning of the original pen, but makes cleaning and replacement extremely difficult. It was decided, therefore, that some arrangement should be made by which the pens could be removed, and which would permit their replacement with extreme accuracy. This was accomplished by an arrangement similar to that shown at left in Fig. 1—a pair of guides which slip over the flat spring at the end of the recorder arm, and a positioning pin which fits into a hole at the base of the spring. By this means pens of four or five standardized lengths may be used on the same recorder arm, and any pen is automatically positioned when applied. This is particularly important in the multi-pen recorders now being used. Here the pens are clustered as at *A*, Fig. 2, and it is essential that minimum distances be maintained between them.

Pens of four sizes are all made from the one blank, *B*, in Fig. 2. The difference is in the length of the pen point and in the length of the shank extending back to the positioning hook. Were blanking dies made for each size of pen the cost would be prohibitive, so we use a single set of blanking dies for all, then trim blanks to the required size on a small trimming press. Six operations complete the pen. They are: (1) pierce and blank, (2) trim pen and tail ends, (3) strike groove, (4) form up sides of reservoir and bend down pen end, (5) close in top of reservoir, and (6) form up ears and set up front of reservoirs. The material is 0.0159 in. (No. 26 B&S gage) nickel silver.

Correct dimensions must be maintained throughout these operations in order that the reservoir may be properly shaped and closed, the pen at the proper angle, and the feed groove clear. As can be seen in Section A-A, Fig. 2, the groove is made as sharp as possible, and extends from a 3/32-in. hole to the extreme tip. Unless this groove terminates at the hole, when the reservoir is closed and the pen bent down, the ink will be unable to flow from the reservoir, since the pierced hole is its only outlet. Other joints are formed so tightly that they hold the ink in the reservoir. Other pierced holes at the lower corners of the reservoir (see blank in Fig. 1) not only provide corner relief in blanking but also aid in forming the tight corner. Were these holes not pierced, the corner formed would be bunchy and not watertight; with them the sides can be brought tightly together, giving a clean corner that will not leak. No solder is used anywhere, the pen as removed from the sixth operation being ready for use when clipped onto the recorder arm. No hand finishing is required.

A number of other types of fountain pens are used for specific services. Two types are illustrated in Fig. 1. Type *A* is a two-piece unit which avoids a diffi-

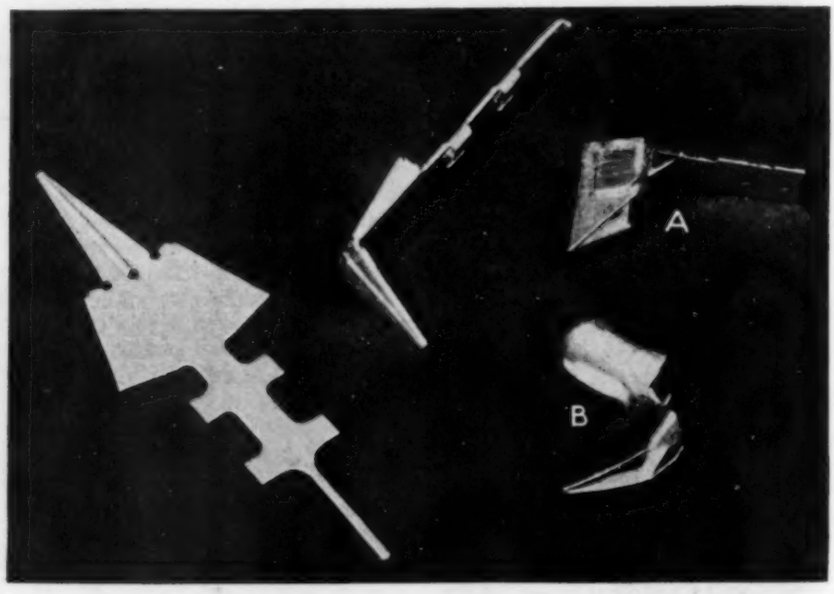


Fig. 1—Nickel silver is used in these three types of fountain pens, two of them of one-piece construction. The pen at lower right is an interesting example in deep drawing, for it is elliptical and has a deep groove at one side which runs into the base of the pen V

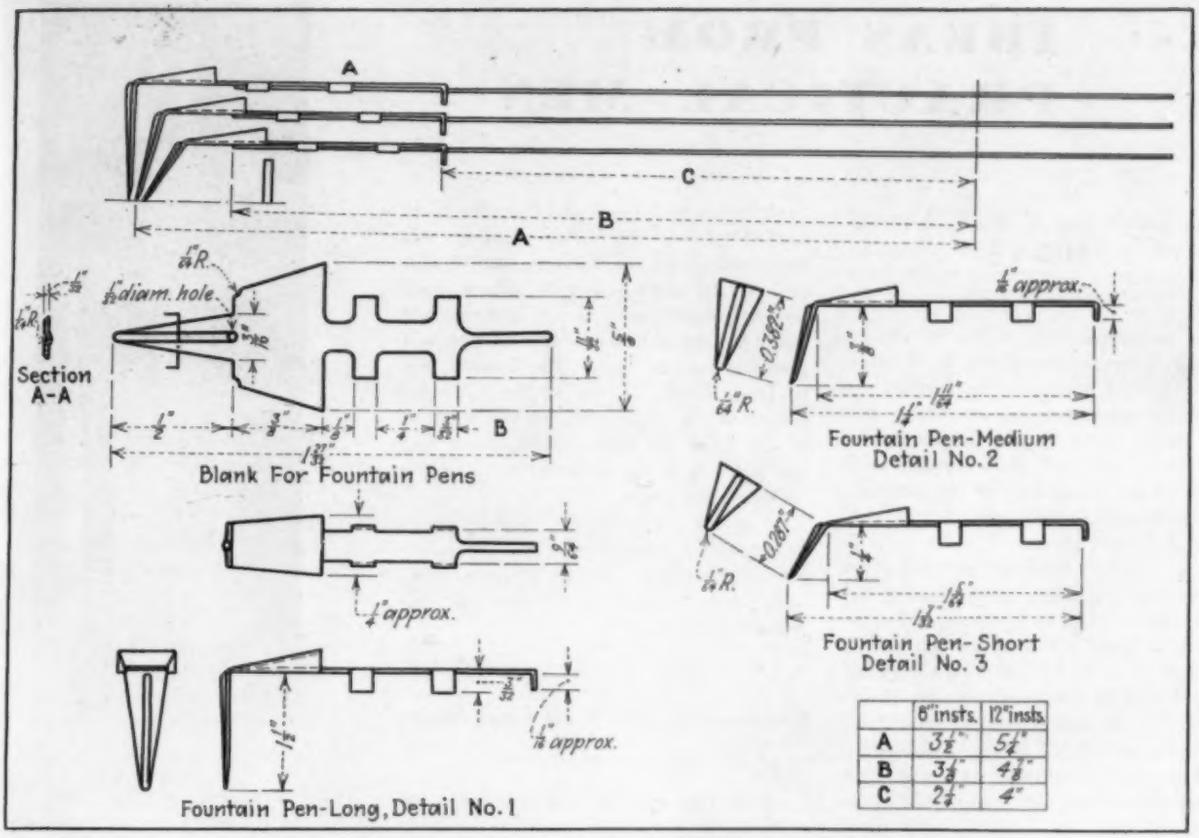


Fig. 2—Details of the fountain pens for 8- and 12-in. two- and three-pen recorders offer some indication of the difficulties involved

cult forming job and permits adjustment by forming the point of a separate piece. By this means, the point may be made of a non-corrosive material, while the shank need not be so expensive a material.

At *B*, Fig. 1, is a one-piece pen that is a difficult forming job. Not only is it an interesting example of deep drawing, but the ink groove at the side of the draw is an additional hazard. It must be made as sharp a V as possible in order that ink will flow by capillary attraction, yet it must not form a kink where it runs into the pen point. The method of drawing the pen is shown in detail in Fig. 3 where eleven of the original thirteen operations are illustrated. The complete series is: (1) blank, (2) anneal, (3) first draw, (4) second draw, (5) third draw, (6) begin forming for bead or groove, (7) form bead, (8) finish bead, (9) trim blank to final shape, (10) anneal, (11) final draw and form V of pen point, (12) form V to final shape and close in top, and (13) bench operation—cleaning up and finishing. Actually the process has now been cut to about ten operations, several of the drawing operations having been combined. There is a lesson in the illustration for almost any deepdrawing. Begin the draw as a dome much larger than the final diameter, and get most of the depth *first*. In this way the desired depth can be attained without breaking, with a square shoulder at the top of the draw and with no crimping or crinkling about the edges.

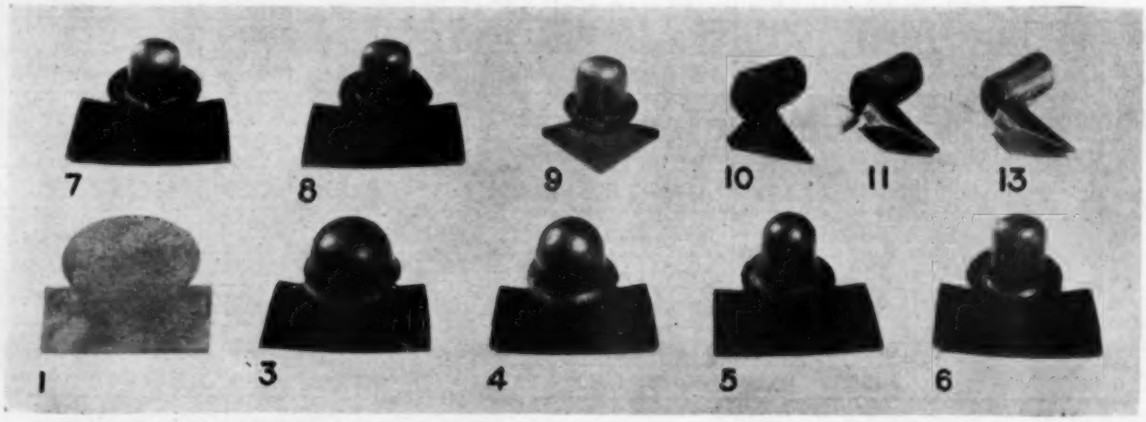


Fig. 3—Study of these eleven operations in the deep-drawing of a fountain pen provides a short graphic lesson in the art. The operations not illustrated are anneals

• IDEAS FROM PRACTICAL MEN

Lead Table for P & W Thread Miller

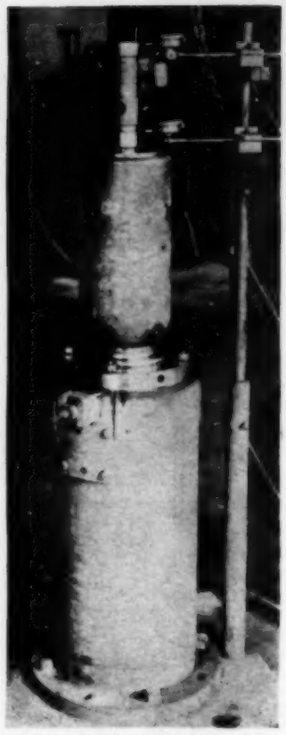
MARTIN H. BALL

The accompanying table of change gears for use on the Pratt & Whitney thread milling machine was worked out for the convenience of operators who were called upon to cut screws having leads that were not given in the table furnished by the makers of the machine. All combinations that can be cut with plain gears are given.

To cut screws having leads not given in the maker's table, compounding the intermediate gears is necessary. For instance, suppose a screw having a lead of 0.875 in. is to be cut. This lead not being found in the accompanying table, it will be necessary to compound the intermediate gears. If the intermediate gears are to be compounded in a three to one ratio, then the lead of the screw to be cut must be multiplied by three. Thus, if the lead of the screw to be cut is 0.875 in., then 0.875x3 = 2.625 and is the number to be looked for in the table. It is found under head stud gear 70 and in line with screw gear 80. Therefore, these gears used in connection with any intermediate gears having a ratio of three to one will give the desired lead.

If intermediate gears having a ratio of two to one are to be used in cutting a screw having a lead of 0.875 in., then the number to be looked for in the table is 0.875x2 = 1.750. This number will be found under head stud gear 70 and in line with screw gear 120. These gears used in connection with any intermediate gears having a ratio of two to one will give the desired lead. The legend "Six to One Ratio" at the upper left-hand corner of the table refers to the position of the lever for the spindle clutch and has nothing to do with the ratio of the intermediate gears.

Thus far we have not had to resort to anything complicated in the intermediate gearing. Ratios of two, three and four to one have met all our requirements.



Inspecting Oil Well Couplings

CHARLES F. HENRY

It is difficult for one unacquainted with oil well practice to realize the loads imposed on the tools used in drilling or in handling the well casing. Few can visualize a boring bar from 3,000 to 7,000 ft. long, yet that is what the oil-well machinery builder must contend with. This means forged steel tool joints and much more accurate alignment of the threaded ends than might be imagined. For it only takes a small variation in each joint to produce great misalignment at 5,000 ft.

The Torrance (Calif.) shop of the National Supply Company uses the device shown to check both eccentricity of the thread and the alignment between the two ends of a tool coupling. The base carries a substantial spindle mounted on ball bearings, the upper end being threaded to fit one end of the coupling. The upright behind the coupling carries two dial indicators.

The coupling to be tested is screwed onto the upper end of the spindle and a test plug screwed in the upper end.

SIX TO ONE RATIO — SCREW GEAR	HEAD STUD GEAR												
	30	40	50	60	65	70	75	80	90	100	105	110	120
30	3"	4"	5"	6"	6.5"	7"	7.5"	8"	9"	10"	10.5"	11"	12"
40	2.25"	3"	3.750"	4.5"	4.875"	5.250"	5.625"	6"	6.750"	7.5"	7.875"	8.250"	9"
50	1.8"	2.4"	3"	3.6"	3.9"	4.2"	4.5"	4.8"	5.4"	6"	6.3"	6.6"	7.2"
60	1.5"	2"	2.5"	3"	3.250"	3.5"	3.750"	4"	4.5"	5"	5.250"	5.5"	6"
65	$1.384\frac{8}{13}$"	$1.846\frac{2}{13}$"	$2.307\frac{9}{13}$"	$2.769\frac{3}{13}$"	3"	$3.230\frac{10}{13}$"	$3.461\frac{7}{13}$"	$3.692\frac{4}{13}$"	$4.153\frac{11}{13}$"	$4.615\frac{5}{13}$"	$4.846\frac{2}{13}$"	$5.076\frac{12}{13}$"	$5.538\frac{6}{13}$"
70	$1.285\frac{5}{7}$"	$1.714\frac{2}{7}$"	$2.142\frac{6}{7}$"	$2.571\frac{3}{7}$"	$2.785\frac{5}{7}$"	3"	$3.214\frac{2}{7}$"	$3.428\frac{4}{7}$"	$3.857\frac{1}{7}$"	$4.285\frac{5}{7}$"	4.5"	$4.714\frac{2}{7}$"	$5.142\frac{6}{7}$"
75	1.2"	1.6"	2"	2.4"	2.6"	2.8	3"	3.2"	3.6"	4"	4.2"	4.4"	4.8"
80	1.125"	1.5"	1.875"	2.250"	$2.437\frac{1}{2}$"	2.625"	$2.812\frac{1}{2}$"	3"	3.375"	3.750"	$3.937\frac{1}{2}$"	4.125"	4.5"
90	1"	$1.333\frac{1}{3}$"	$1.666\frac{2}{3}$"	2"	$2.166\frac{2}{3}$"	$2.333\frac{1}{3}$"	2.5	$2.666\frac{2}{3}$"	3"	$3.333\frac{1}{3}$"	3.5"	$3.666\frac{2}{3}$	4"
100	0.9"	1.2"	1.5"	1.8"	1.95"	2.1"	2.250"	2.4"	2.7"	3"	3.15"	3.3"	3.6"
105	$0.857\frac{1}{7}$"	$1.142\frac{6}{7}$"	$1.428\frac{4}{7}$"	$1.714\frac{2}{7}$"	$1.857\frac{1}{7}$"	2"	$2.142\frac{6}{7}$"	$2.285\frac{5}{7}$"	$2.571\frac{3}{7}$"	$2.857\frac{1}{7}$"	3"	$3.142\frac{6}{7}$"	$3.428\frac{4}{7}$"
110	$0.818\frac{2}{11}$"	$1.090\frac{10}{11}$"	$1.363\frac{7}{11}$"	$1.636\frac{4}{11}$"	$1.772\frac{8}{11}$"	$1.909\frac{1}{11}$"	$2.045\frac{5}{11}$"	$2.181\frac{9}{11}$"	$2.454\frac{6}{11}$"	$2.727\frac{3}{11}$"	$2.863\frac{7}{11}$"	3"	$3.272\frac{6}{11}$"
120	0.750	1"	1.250"	1.5"	1.625"	1.750"	1.875"	2"	2.250"	2.5"	2.625"	2.750"	3"

Divide lead by three for using 2 to 1 ratio
Use drive to spindle for 3" lead and less
Use drive to screw for over 3" leads

PRATT & WHITNEY
6" THREAD MILLING MACHINE
LEAD TABLE

This plug has two ground diameters 6 in. apart, by which the indicators measure both eccentricity and alignment. The coupling is easily revolved on the ball bearing spindle, and the eccentricity is checked by the lower gage. If the threads in the coupling are in exact alignment both gages will indicate the same amount of eccentricity, if any. Any variations in the indications show lack of alignment. If, for example, the lower gage shows 0.010 and the upper gage 0.018 in., the eccentricity is 0.010 and the difference, 0.008 in., is the error in alignment for the distance between the gages. This permits an easy check of variation. The spindle can be locked against rotation while couplings are being removed or replaced by a stop in the base.

Automatic Milling Fixture Clamp

EDMUND E. BURKE
Kent-Owens Machine Company

We were to mill Woodruff keyways in a number of shafts of the same diameter. The self-clamping fixture illustrated was designed for this work. In making the cut, the head of the machine is fed vertically by hand, this movement serving to operate the clamping device.

The work is held in a simple V-block fixture with a clamp at the forward end. The clamp is normally held in the raised, or open, position by a spring beneath it, the eccentric under the clamp being dropped forward to permit this release. Fastened to the overarm is a clamp carrying a stud and compression spring assembly extending down to the fixture for actuating the fixture clamp. The lower end of the stud is fastened to a lever arm pinned to the same shaft as the clamp eccentric arm. As the head is fed downward, the spring on the connecting stud gradually builds up pressure, thus causing the eccentric to swing under the end of the clamp and locking the shaft tightly. Reverse motion releases it. Vertical movement of the head in both directions is adjusted by a stud and locknut arrangement, engaging the head and a bracket on the frame.

Fixture for Grinding Bronze Washers

OSBERT E. CHARLES

Having to grind both sides of a very large quantity of bronze washers, I designed the fixture illustrated for holding them. The washers were 2½x0.125 in. and were made from the bar on an automatic screw machine, being oil-grooved on both sides before grinding.

Referring to the illustration, the base *A* is ground on top and the bottoms of the slots *B* are ground to a uniform distance from the top of the base. The five holding plates, or jaws, *C* are in reality double, thin, V-blocks and are 0.005 in. thinner than the washers. The plate at the extreme left is stationary, while the others are fitted to slide, the one at the extreme right being moved by a cam. When the fixture is fully loaded, closing the cam locks all the washers. The sides of the V-s in the holding plates, or jaws, are undercut at an angle of 5 deg., so that after the cam lock has been closed and the washers bedded down against the top of the base by a mallet, there is no tendency for them to rise.

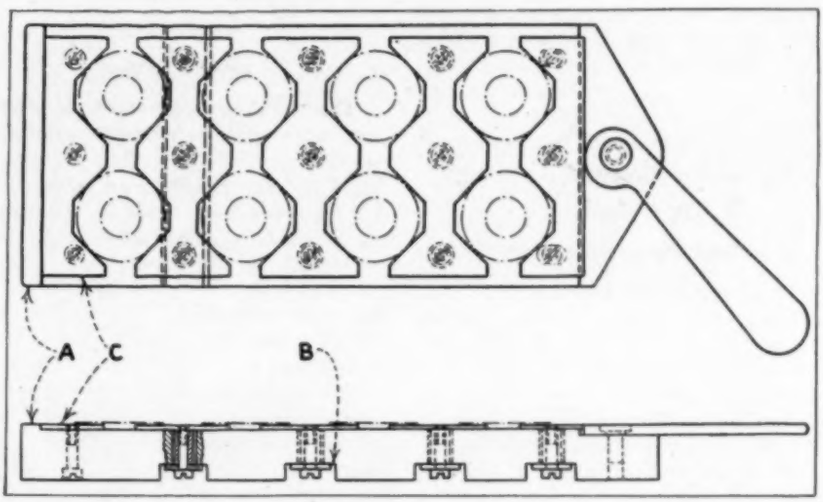
The movable holding plates, or jaws, are held in contact with the top of the base by screws passing through hardened and ground bushings of uniform length, which are placed in clearance holes in the base to permit the plates to be moved in clamping and also to permit them to have a certain amount of sidewise float. The fixture was held by a magnetic chuck mounted on the table of the surface grinder.

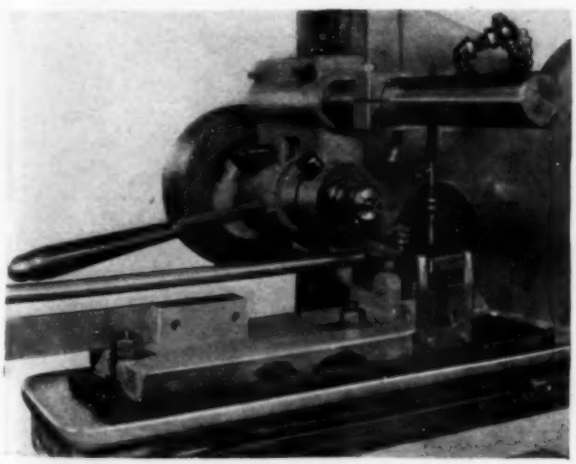
Checking External Bevels

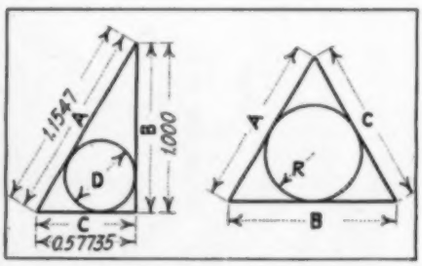
CHARLES KUGLER

In looking over the article by John F. Thorton under the title given above (*AM*—Vol. 76, page 738), I was reminded of some of the formulas I have used in checking such work.

The problem consists in finding the diameter of an inscribed circle in a triangle in which the lengths of the respective sides are known. In Wentworth's Plane and Spherical Trigonometry, the following formula is given for solving the problem in any triangle:







$$R = \sqrt{\frac{(S-A)\ (S-B)\ (S-C)}{S}}$$

In which *R* is the radius of the inscribed circle in a triangle where *A*, *B* and *C* are the lengths of the respective

sides, and $S = \frac{A+B+C}{2}$

The reason some toolmakers do not use this formula is not because they do not know of it, but because it involves too much mathematics.

A method of finding the diameter of the incribed circle in a right triangle, as in Fig. 1, where the lengths of the respective sides are known is as follows: $D = (B+C) - A$. In which A, B and C are the lengths of the respective sides, and D is the diameter of the inscribed circle. For example: let $B =$ 1 in., $C = 0.57735$ in. and $A = 1.15470$ in. Then $1 + 0.57735 = 1.57735$ and $1.57735 - 1.15470 = 0.42265$ in., which is the diameter of the inscribed circle. It will be seen that this formula involves nothing but simple addition and subtraction. If Mr. Thorton had used this formula for solving the problem in Fig. 1 of his article, his work would have been greatly simplified.

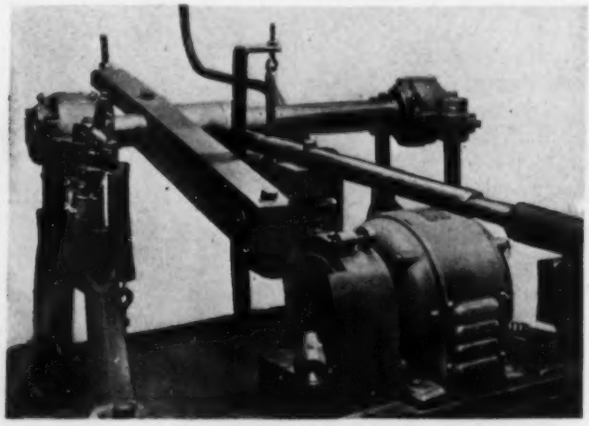
For finding the radius of an inscribed circule in an equilateral triangle, as in Fig. 2, in which the length of any one of the sides is known, the following simple formula is all that is necessary: $R = A \times 0.288675$. In which A is the length of any one of the sides, 0.288675 is a constant, and R is the radius of the inscribed circle.

Squaring Sleeve Couplings By Grinding

HERBERT F. CRAWFORD

The Emsco shop, Los Angeles, Calif., makes a lot of threaded sleeve couplings for oil pump rods. Although the exact length is not important, these couplings must have the ends square with the threads. Grinding was decided upon as the proper method and the little machine shown was designed for the purpose. It consists of the shaft properly mounted in bearings, this shaft carrying an arm and handle which are clamped to it. At the back end of the arm is a spring, while the front end carries the workholder. The workholder is a segment of a circle having threads on the upper side that correspond with those of the coupling. The coupling goes over the end of the holder, projecting enough to be ground square by the ring grinding wheel mounted directly on the motor spindle.

The coupling is slipped over the end of the holder and clamped by bringing the block on the handle in contact with it. The spring on the handle is considerably lighter than that on the arm, but is strong enough to raise the handle and block from the work. Further movement of the handle forces the arm and the work past the end of the ring wheel and grinds the end square with the thread. The heavy spring counterbalances the weight of both the arm and the handle, while the lighter spring only handles the weight of the handle and the holding block. Such a combination has possibilities for a variety of other work.



Indexing Mechanism for a Conveyor

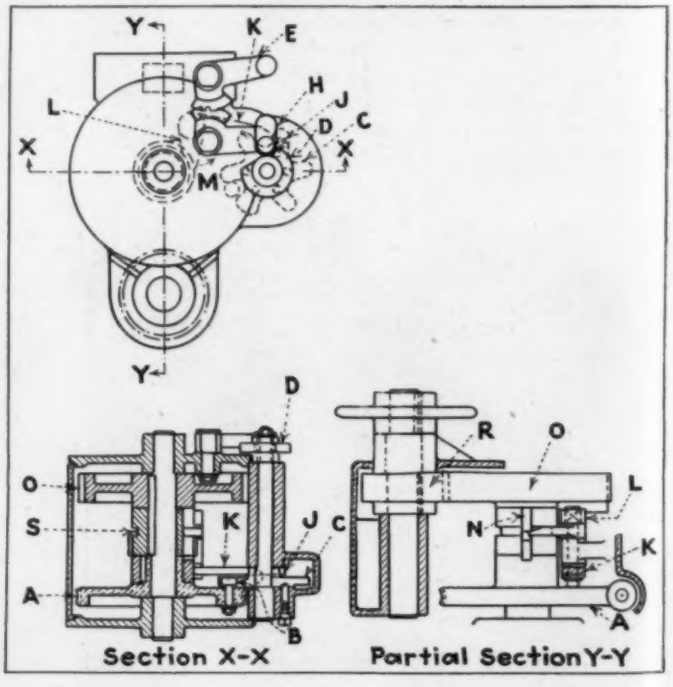
EDWARD HELLER

The mechanism illustrated is used in connection with an automatic, multiple-spindle machine for buffing and polishing head-lamp reflectors for automobiles. Its functions are to raise the wheels out of the work, index the conveyor to bring new work to the wheels and to lower the wheels into the work, so that polishing can proceed for a predetermined time.

Motion is imparted by motor-driven worm gearing, the wormwheel A revolving freely on its shaft and carrying the roller B, which revolves the shaft intermittently by engagement with the six-toothed spider C. The cam D on the wormwheel shaft has a dwell of 240 deg., a quick drop and a short dwell of 60 deg. and a gradual rise of 60 deg. The sector levers E and H are connected to a system of simple tie rods and bell cranks in such a way that when the ends are pushed toward each other, they hold the polishing wheels in the work, but when that part of the cam having a quick drop comes into contact with the cam roller on lever H, the polishing wheels are lifted out of the work, due to the unbalanced mounting of the wheel units.

The roller J is so located on the spider C as to strike the trip lever K just when the wheels are almost out of the work. The trip lever is keyed to the same shaft as is the clutch dog L, so that when the lever and the dog are moved in the direction of the circular arrow M, the clutch key N, is forced down by a spring into the pocket in a steel ring attached to the wormwheel. This action connects the wormwheel with the spur gear O, which is in mesh with the pinion R. The ratio of the gear and the pinion is 2 to 1, so that when the gear O has made one revolution, and that is all the clutch can stay in engagement at one time, the shaft that carries the sprocket makes two revolutions, and the size of the sprocket is such that it moves the conveyor chain the desired amount.

Trip lever K is held out long enough for the clutch to engage. When the roller J gets past the curved tip of this lever, a spring (not shown) snaps the clutch dog L into the groove S, where it



waits until the key comes around to ride up on its bevel face and out of engagement. There the key remains until the roller on the spider gets around again to trip the lever, which takes place once in every six revolutions of the wormwheel. The timing of the job is on the basis of completing the entire cycle in 24 sec., and that ten reflectors are to be polished in that time.

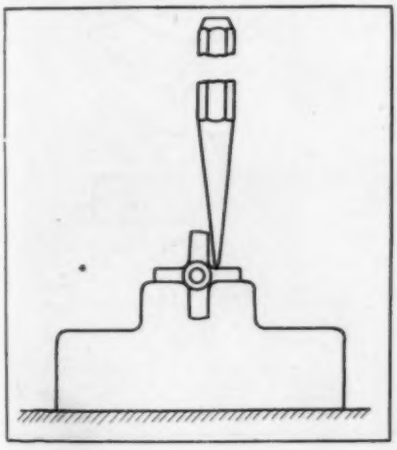
Tools of Reamer-Section Steel
Discussion

J. T. TOWLSON
London, England

The article under the title given above by Herbert M. Darling (*AM*—Vol. 76, page 498) is an altogether excellent contribution in respect to the useful adaptations of the steel in question. I have used this steel (called star-section steel in England) for nearly 30 years for wall drills, reamers and taps.

However, Mr. Darling has omitted to call attention to one important feature possessed by this steel, and that is the ease by which tools made from it, especially reamers, can be brought back to size when worn below the limit of usefulness. Worn tools can be annealed and then peened enough for grinding to size after hardening. This process can be repeated several times. For making a substitute for shell reamers, which can not be reconditioned by peening, and especially for line reamers, this steel has been adopted with eminent success.

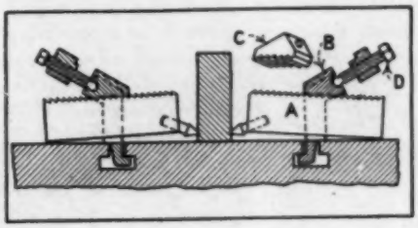
Referring to the illustration, to recondition the tool it is placed on a cast-steel anvil having a slot in which one of the blades will lie. A staking tool, applied as shown, and a hammer are the only necessary tools for the peening operation. If the tool is a long one, two anvils can be mounted on a plate in tandem. The face of the anvil should be hardened, so that each and every blow on the staking tool will have quite an appreciable expanding effect.



"Hold Downs" for the Planer

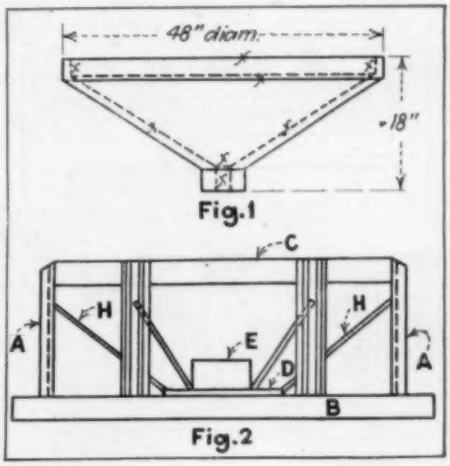
DANIEL DOOLITTLE WELLS

The "hold downs" illustrated were developed as an improvement on the ordinary hold downs with which all planer operators are familiar. Each unit consists of the bar *A* having ratchet teeth, the angular block *B*, shown in detail at *C*, held in a yoke, and the ball-ended screw *D*. Spikes having chisel points are set at an angle in the end of the bar *A* next to the work. The yoke straddles the bar *A* and terminates in



a hook that can be dropped into one of the T-slots at any part of the planer table. This feature is a time saver, as it is not necessary to enter the hook in the T-slot at the end of the table and to slide the yoke to its place. The upper end of the yoke is inclined at an angle of about 30 deg. The angular block *B* fits in the yoke on top of the bar *A*, the ratchet teeth of both members engaging. At the back end of the angular block is a spherical seat in which the ball end of the screw engages.

Referring to the illustration, it will be seen that the end of bar *A* carrying the spikes does not touch the table, while the opposite end rests firmly upon it, serving as a fulcrum point. The force of the cut tending to lift the work from the table is transmitted to the yoke as a straight, upward lift, which it is best able to resist. When the work is held by ordinary "hold downs," the lifting force acts almost at right angles to the clamping strain. For this reason, the "hold downs" described are superior.



A Welded Fixture for the Boring Mill

H. K. GRIGGS

The utility of a welding outfit was demonstrated in making a fixture for machining some cast-iron cylinder heads in a 60-in. vertical boring mill, one of the cylinder heads being shown in Fig. 1. The fixture, Fig. 2, was made from steel bars, shapes, pipe and a piece of boiler plate, all of which were torch cut and then fabricated by electric welding.

Six pieces of 4-in. channel *A* were bent at the lower ends to form feet for bolting to the machine table *B*. A $\frac{3}{8}$x3$\frac{1}{2}$-in. bar *C* was formed into a ring 49 in. in inside diameter and was welded to the upper ends of the channels. A steel plate *D*, $\frac{3}{4}$ in. thick and 18 in. in diameter, formed the center piece, and to it was welded the short piece of 8-in. pipe *E*. The six braces *H*, $\frac{1}{4}$x2 in., were welded to the center plate and to the channels to act as stiffeners. The fixture was attached to the boring mill table by bolts through the center plate and the feet of the channels. Holes for the necessary screws and clamps for holding the work were drilled and tapped.

The material was nearly all culled from the scrap pile and the labor cost was less than $5. If a cast-iron fixture had been made, it would have cost at least $50, including the patterns. This price would have been prohibitive, since there were but three cylinder heads to be machined.

Grinding Synthetic Resin Compounds

HARRY SHAW
Consulting Engineer, Heywood, England

A polish-grinding operation on parts made from a synthetic resin compound had to be followed by extended buffing to remove very fine scratches left by the grinding. Many makes, grades and grits of wheels were tried without eliminating the scratches. It was finally realized that the scratches were produced by very fine particles of the grinding wheel which, when loosened by the dressing diamond, entered the fine pores in the surface of the wheel. During the grinding these particles gradually came out on the surface of the wheel and so produced the scratches.

The trouble was cured by fixing a brush that swung over the surface of the wheel after every dressing with the diamond. In addition a powerful jet of compressed air was directed on the wheel to remove the fine grit loosened by the brush.

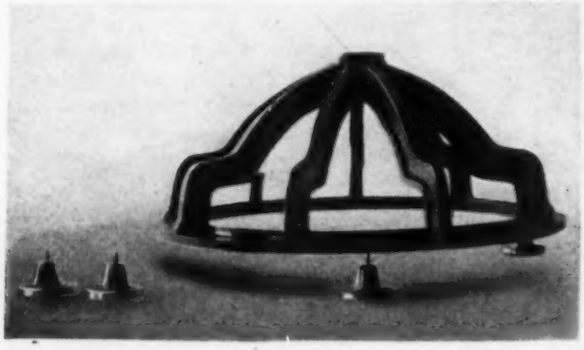
Experienced grinders of synthetic

compounds often pass a piece of fine emery cloth across the face of the grinding wheel after dressing to remove any loose pieces of grit left on the wheel.

Supports for Patterns While Drying

MALCOLM K. PARKHURST

The supports illustrated are easily made and provide a satisfactory means for supporting freshly-varnished patterns without danger of the supported surfaces being marred. The bases are made of castings or from bar stock. Phonograph needles, point upward, are inserted in the bases. Three supports are used under each pattern.



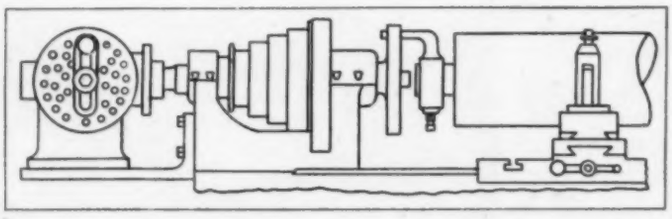
Accurate Spacing in the Lathe

CHARLES KUGLER

On reading the article by R. Henderson, 3d, under the title given above (*AM*—Vol. 76, page 769), I was reminded of an application of a dividing head to a lathe that I saw in a plant making textile machinery. Longitudinal grooves were being cut in a roll that was too long to go between the centers of the milling machine.

The dividing head was mounted on a bracket attached to the outer end of the headstock, as shown in the illustration. Plugs in the dividing head and in the rear end of the hollow spindle of the lathe were coupled together, permitting the spindle to be driven by the dividing head. Indexing was, of course, done by the dividing head and the grooves were cut in the work by traversing the carriage back and forth by hand, the depth of cut being controlled by the cross-feed screw. The tool was held with its cutting edge at 90 deg. to the usual setting.

With this arrangement, it is evident that the full capacity of the dividing head can be used for accurate spacing.



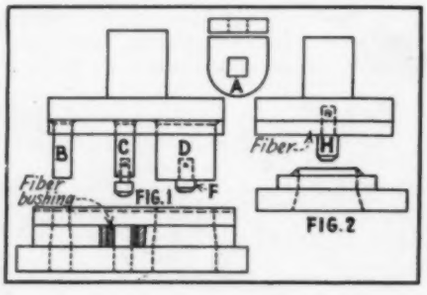
Press Tools for Fiber

WILLIAM ANDERSON

In making press tools for the fiber piece shown at *A* in the illustration, much time was spent in experimenting before pieces having smooth edges could be produced. However, the tools illustrated produced work that was satisfactory in every way.

In the tools in Fig. 1, the work is fed from left to right, the first operation being to pierce a $\frac{1}{16}$-in. round hole with the punch *B*. Advancing the stock to the square punch *C*, which has a keen edge, the material around the hole is shaved and the hole is made square, the work being located by the $\frac{1}{16}$-in. round pilot. A square fiber bushing in the die under punch *C* is necessary to protect the keen edges of the punch from injury. The stock is then advanced to the blanking punch *D*, being located by the square pilot *F*. Here the piece is blanked $\frac{1}{8}$ in. large all around to allow for shaving to size.

In Fig. 2 are the shaving tools. The hole in the die is straight, highly polished and is of the same size as that of the finished piece. Polishing the straight hole makes the edges of the finished piece smooth and free from scratches. The square pilot *H* on the punch locates the work correctly before the punch contacts with it. The fiber facing on the punch-holder pushes the work into the die slightly below the cutting edges. If metal were to come into contact with the keen edges of the die, they would be injured. Each piece that is shaved pushes the previously-shaved piece a little farther into the die. This die is left soft and is sharpened with a file when it becomes dull.



Tools for Transferring Holes
Discussion

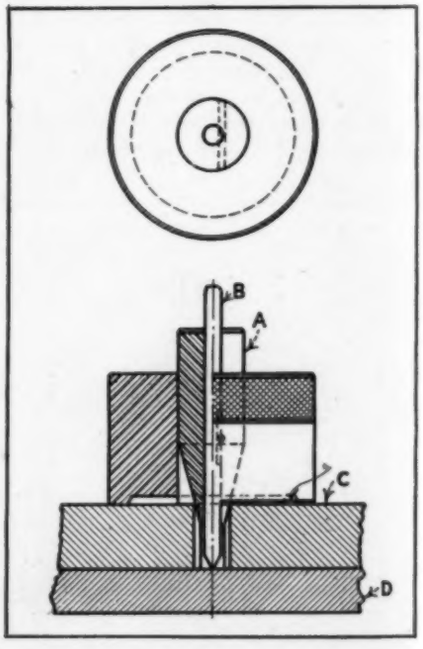
FORREST L. JOHNSON

Tool Designer, Westinghouse Electric & Manufacturing Company, Mansfield Plant

The article by Edward Heller under the title given above (*AM*—Vol. 76, page 21) and the discussion thereon by George Siegrist (page 650) were most interesting, suggesting practical methods for transferring holes.

My practical experience leads me to state that the hole to be drilled is usually either smaller or larger than the hole from which it has been transferred. Therefore, there is little use for the scribing tools described by Mr. Siegrist. A light center mark and a circle scribed therefrom by a pair of dividers fulfill the requirements for layout work.

The accompanying sketch illustrates a tried-out method for transferring holes, or rather locating their relationship, from straight, taper or other holes, either plain or tapped, the taper on the plunger



A compensating for the variables mentioned. The device is a practical tool for toolroom work covering holes from $\frac{1}{16}$ to $\frac{3}{4}$ in. in diameter. The body is tool steel and a $\frac{3}{4}$-in. hole, a slip fit for the plunger, is drilled and reamed. Recessing the bottom of the body for dirt clearance has advantages, and the knurling facilitates handling. The plunger is made from $\frac{3}{4}$-in. drill rod and has a $\frac{1}{16}$-in. hole in which the center punch *B* is a slip fit. A pin through the plunger, engaging a recess in the center punch, keeps the center punch from falling out when the tool is moved. Hardening and grinding all the parts adds to both the accuracy and the life of the tool.

In use, the part *C*, from which the hole is to be transferred is superposed on the work *D* and the taper point of the plunger is forced into the hole, centering the tool. The center punch is then struck by a hammer, making a mark in the work. Using the center-punch mark as a center, a circle of the correct diameter is scribed with the dividers. If the hole to be transferred is large in relation to the thickness of the part it is in, it may be necessary to place parallels between the part and the work to prevent the end of the plunger from contacting with the work before the tapered part fills the hole to be transferred.

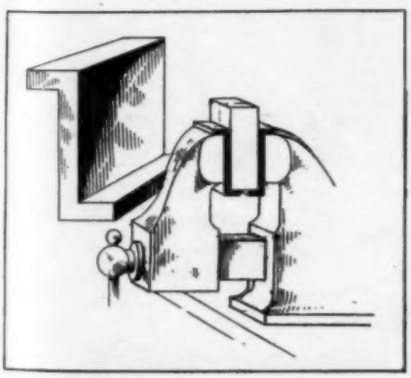
Auxiliary Jaws for the Vise

AUGUST JEFFERS

Foreman, Monroe Machine Company

The auxiliary jaws shown in the vise in the illustration will greatly aid users of bench vises in holding work. Anyone who has done much chipping or hard filing has learned how difficult it is to prevent the work from slipping in the vise jaws.

To overcome this difficulty, I made the auxiliary jaws shown in the sketch, bending them from pieces of $\frac{1}{8}$-in. iron. One of the auxiliary jaws will do for light work, but for heavy work it is better to use both. The auxiliary jaws can be made the same length as the width of the vise jaws, or four short jaws can be used, one on each end of the two vise jaws. The supporting ledges on the auxiliary jaws aid greatly in preserving the finish on work, which is likely to be marred by constantly slipping in the vise. For highly finished work, the auxiliary jaws can be made of heavy sheet copper or brass.



Cutting Small Thin-Walled Tubing

WALTER C. SCHMIDT

Tool Engineer, Brown Instrument Company

Any thin tubing is difficult to cut accurately on a production basis. When that tubing is aluminum, has walls only 0.0015 in. thick, and must be cut exactly to length without smashing and without burr, then cutting becomes a real problem.

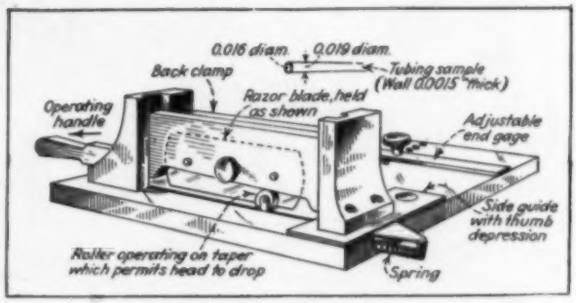
That problem faced us in the making of pointers for potentiometer-pyrometers. The tubing is 0.019 in. outside diameter and has walls 0.0015 in. Any smashing or burring would hamper later production operations and seriously weaken the tubing. Solid pointers add undesirable weight. Several methods were tried for cutting tubing, including speed shearing, but none worked satisfactorily.

The fixture used resembles a guillotine with a controlled stroke. Two uprights form the groove down which the knife-holder passes. The knife-holder is simply a flat plate with a clamping back which holds an ordinary razor blade. The blade holder has a lower guiding surface cut at an angle. This angular surface rests upon a small roller which is in turn fastened to a horizontal slide passing beneath the uprights.

The horizontal slide is slightly above the surface of the table and passes out at each side under the uprights. The left end terminates in the operating handle and at the other is bent and holds a retaining spring in place. When the operating handle is pulled, the slide passes under the knife holder, the roller moving with it to permit the head to lower the blade on the tubes. Since the slide clears the table slightly, anything placed upon it and held by the knife will roll as the slide is withdrawn, thus tubing placed against the side guide will roll under the knife. The weight of the knife holder is sufficient to cause the razor blade to groove and then to cut the tubing, without smashing it and without leaving a burr. When the operating handle is released, the spring returns the slide automatically. Cutting action is almost exactly the reverse of that in cutting pipe by hand.

Tubing with walls as thick as 0.0025 in. has been cut by this means on a production basis, and the razor blades hold up surprisingly well, as several thousand pieces can be cut before dulling. Only a half of each cutting edge is utilized at one time in cutting, thus the blade can be used in four positions by reversing and turning before it is honed or discarded.

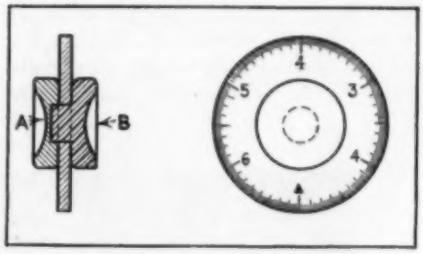
A simple bar gage is screwed to the rear end of the table to permit adjustment for tube length. The fixture is used for cutting sixteen different lengths of pointers for various types of indicating instruments, and the base carries index holes for the gage bar for all positions.



A Circular Scale

J. ROETHISBURG

The circular scale illustrated is very convenient for measuring the outline lengths of circular or irregular work, such as is often encountered in making tools and dies. The scale is made by turning a disk to a diameter of 1.9098+ in. or equal to a circumference of 6 in. The edge is knurled to give it a better grip on the work. Graduating is done in the universal milling machine. The pieces *A* and *B* for the thumb and forefinger are pressed together through the central hole.



In using the scale, it is held lightly by the balls of the thumb and the forefinger and is rolled along the outline of the work or the drawing, much in the same way as a planimeter is used.

SHOP EQUIPMENT NEWS

Ingersoll Rail-Type Milling Machine Weighs 275 Tons

Said to be the largest milling machine ever built in this country, this machine has capacity for a casting 15 feet wide, 11 feet high, and 40 feet long. The bed is 80 feet long and the overall height 20 feet. The machine weighs nearly 275 tons and required 11 flat cars to ship it to its destination. It was built by the Ingersoll Milling Machine Co., Rockford, Ill.

It is an adjustable rail type mill with four heads—two vertical, on the crossrail, and two horizontal, on each housing. Each head is driven by its own individual motor which is independent, reversible and with variable spindle speeds. It is thus possible to use a 6-in. cutter on one head and an 18-in. cutter of the opposite hand, on another head at the same time, and with the proper spindle speeds for each cutter.

The machine is equipped with a right angle boring and milling attachment which may be applied to either vertical head and which includes a high-speed drilling attachment.

All controls are centralized at one station and carried in two panels. One panel controls the four drive motors with a push button and rheostat control for each. The other panel includes the feed motor control and all gear change levers. A pendant switch permits the operator to start, stop, or jog the machine while standing at either side or on top of the table.

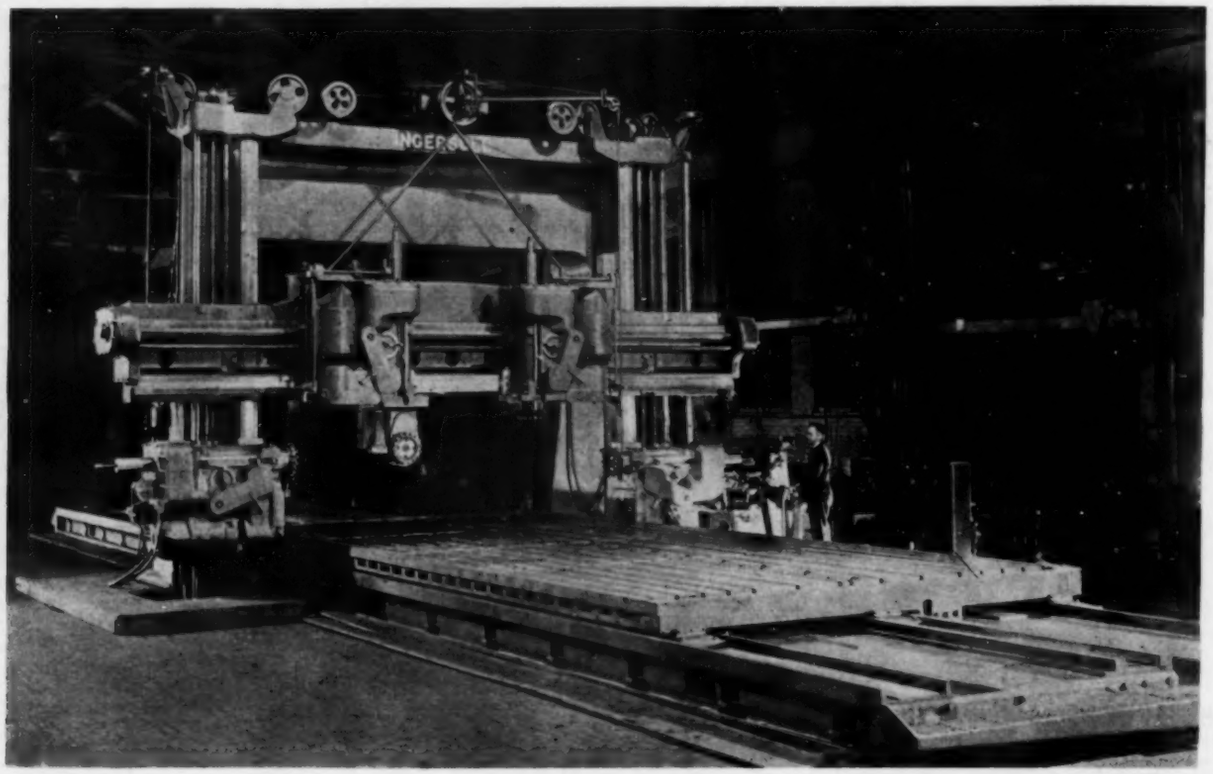
The feed motor is also independent and with variable speed. It provides feed and rapid traverse in either direction to the table, rail, heads, and quills. Although the feed and rapid traverse to all units are independent of one another, it is possible to set the rate of feed on all units at the same point.

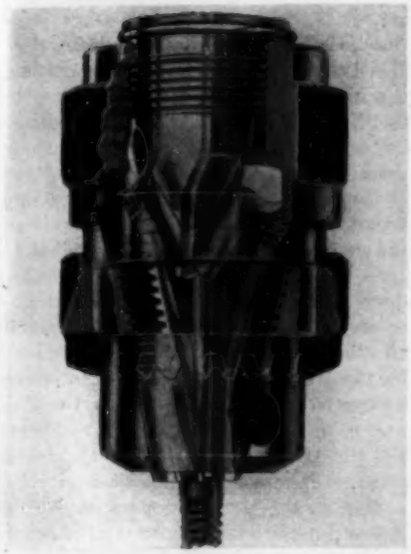
The feed mechanism and table ways are lubricated by independent oil pumps and filters. The crossrail has a centralized one-shot lubrication system to all bearings and gears, and there is also forced-feed lubrication to the heads and ways. Drive gears are of chrome-nickel steel. The heads have anti-friction drive bearings. The crossrail and the horizontal heads are counterbalanced.

Limit switches provide against overtravel of the table, rail, or any of the heads, so that an accident through carelessness of the operator is forestalled. An overload on the drive motors is controlled by an automatic cut-out. Ease of control is demonstrated by the fact that the operator is able to set any adjustment to 0.001 in. with the jog button control.

Jacobs Positive Drive Tap Chuck

Designed for heavy duty or light sensitive tap holding, a positive drive tap chuck has been developed by The Jacobs Mfg. Co., Hartford, Conn. The front jaws hold the tap by the shank, and the back jaws drive the tap by the





square, but the floating construction is said to correct any error in the concentricity between the shank and the square on the tap. For light tapping, the chuck may be hand-operated. The geared sleeve and key are provided for heavy-duty tapping. The key handle of the chuck wrench fits the spanner holes on the back sleeve, and may be used where the chuck is operated on multiple spindles. Arbor holes are interchangeable with standard Jacobs drill chucks. Three models are available: No. 255 takes hand taps from 0 to ¼ in.; No. 318, from 0 to ⅜ in.; and No. 381, from 10-32 to ½ in.

Internal Attachment for Zeiss Vertical Optimeter

Inside measurements with a range of from ¼ to 4 in. in fractions of 0.00005 in. can be obtained with an adjustable internal attachment, which is now available for the Zeiss vertical optimeter, an optical precision amplifying gage. Zeiss instruments are sold in this country by the George Scherr Co., 128 Lafayette St., New York, N. Y.

Heretofore the vertical optimeter has been limited to outside measurements. The feature of the inside attachment is the accuracy in measuring to within 0.00005 in., and also that the attachment can be adjusted in such a way that bores as small as ¼ in. and as large as 4 in. can be checked with the same equipment. Means are also provided for determining taper and for finding both minimum and maximum diameter of bore. The attachment fits the optimeter by slipping it over the vertical post and clamping it in position at the rear, so as to leave the standard

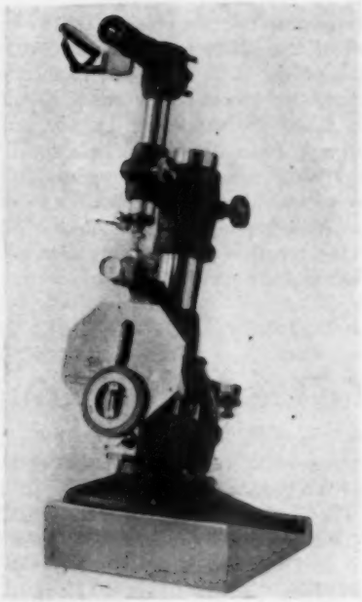


table unencumbered. Two measuring jaws contact the hole by means of ball tips. The upper jaw is adjustable, but fixed in position during the measuring operation. The ring is suspended, and the lower jaw affects the measuring motion and transfers it to the measuring anvil of the optimeter tube, by which the amplification is performed optically, so that one 0.0001 in. will appear as large as ⅛ in. in the ocular, or as large as ⅛ in. when projected on the screen.

Taper of the bore is observed visibly by shifting the back plate in and out. Maximum diameter is determined by swinging the ring slightly on the upper contact tip as a pivot. Minimum diameter is found by tilting the back plate in a vertical plane. Setting of the instrument is accomplished either by a master ring or a snap gage built up from gage blocks. An independent fine adjustment for the zero position is provided underneath the measuring anvil.

Elwell-Parker Die-Handling Truck

A large capacity, telescoping, upright tiering truck for die-handling has been developed by the Elwell-Parker Electric Co., Cleveland, Ohio. The particular truck illustrated was designed for the removal of 4½-ton dies from the presses, transporting the dies through 7 ft. 6 in. high doorways and beneath the low piping to die storage, and then placing the dies in racks, four compartments high.

The truck approaches the press head-on, and the cantilever platform is elevated to the level of the press bed. Two cables with hooks midway the height of the uprights are led out under the sheaves at the bottom of the uprights

and attached to the die. A winch on the truck winds in the cables, and draws the die onto the platform of the truck. The platform is then lowered and the die transported to die storage. At this point the truck approaches the storage rack head-on, and the platform is elevated to the proper heighth in the rack. Maximum elevation of the truck is 108 in. Before elevating the platform with its load, two winch cables are passed around the two sheaves at the forward end of the platform and hooked to the back of the die. The load is then elevated, the winch motor started and as the cables are wound in, the die is slid forward from the truck platform to its storage berth on the rack. To remove the die from the rack a reverse operation is necessary. Over-all height of the truck is 88 in. Capacity of the truck is 10,000 lb. to 106 in.

"Kipp-Caster" No. 11 Die-Casting Machine

A small die-casting machine known as the "Kipp-Caster" No. 11—The Mechanical Foundry—has been developed by the Madison-Kipp Corp., 201 Waubesa St., Madison, Wis. Features of this machine are: Its size; its ability to handle all common die-casting alloys, including magnesium; its quick die-changing arrangement; its convertibility into a permanent mold machine for casting brass; and its simple operation.

The machanism is built into a one-piece body made of a semi-steel casting to which is attached a one-piece leg casting which is bench high. Eessential parts are: base, body, ram, main pinion operated by spoked wheel, metal well, metal forcing plunger, plunger-operating lever and die-locking plunger.

The stationary die half is mounted on the head platen by means of one locating pin and one wing nut which takes its final lock from a hammer blow. The movable die half is mounted on the ram diehead by means of one locating pin and two bayonet cam tracks which fit over two pins of the ram ring. The handle of the ram ring is struck with a lead hammer for its final lock.

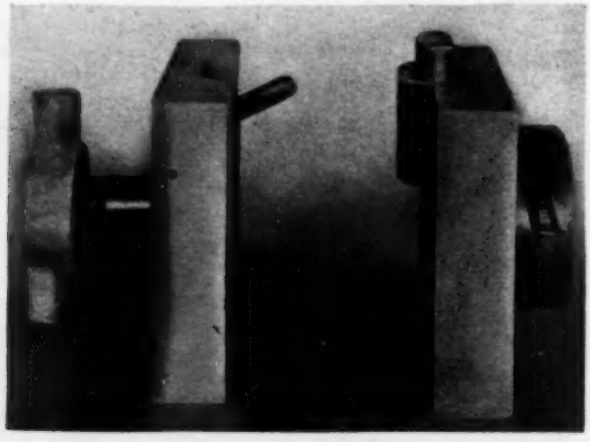
The ram carries the movable die half up to the stationary die half when the spoked wheel is rotated to the left or forward. The main pinion wheel, which operates the ram, also moves an auxiliary rack, which through a lever positions the metal well under the dies. When the dies are in the closed position, the metal well is brought tightly up to the bottom of the die. The auxiliary metal well rack is equipped with a threaded stud extending up to the top of the rear body for setting the pressure adjustments. When the dies are closed the metal well is automatically raised to the casting position, and when they are open the well is lowered automatically to the pouring position. A die lock is effected by means of a taper machined on the rear end of the ram onto which a tapered plunger drops when the dies are in closed position. This prevents the dies from opening when the metal pressure is applied to the die cavity.

The metal plunger operates in the sleeved metal well by means of a heavy lever whose fulcrum is close to the metal well, whereas the operating handle extends to the rear of the machine for leverage. In the idle position, the plunger lever is latched. To apply pressure to the metal, the lever may be merely unlatched and allowed to fall, or it may be pumped.

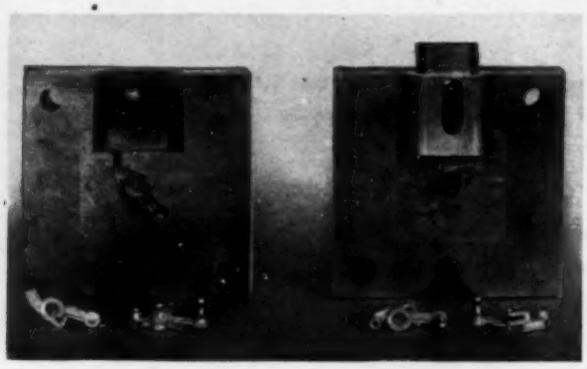
Operating procedure is as follows:

Pressure Casting

1. Metal is poured into the metal well by a ladle from an auxiliary furnace.



An operating lever with steel insert is produced



2. Dies are closed by means of spoked wheel.
3. Metal plunger lever is unlatched or pumped.

Reverse Order

1. Metal plunger lever is raised.
2. Die-locking plunger is raised.
3. Dies are opened by means of spoked wheel.

Dies for use on Kipp-Caster No. 11 are identified as Kipp cam lock dies. They are made of cast iron, alloy iron, or die steel, depending on the kind of metal to be cast and the length of the run. Core pulling is accomplished automatically with the opening and the closing of the dies. An angle guide pin may be used for a core pull or a lever and roller traveling in a cam track may be utilized. A parting line splash guard moves in unison with the movable die half, but in opposite directions. The inside of the guard is corrugated to hold any metal which may accidently cut out from the die.

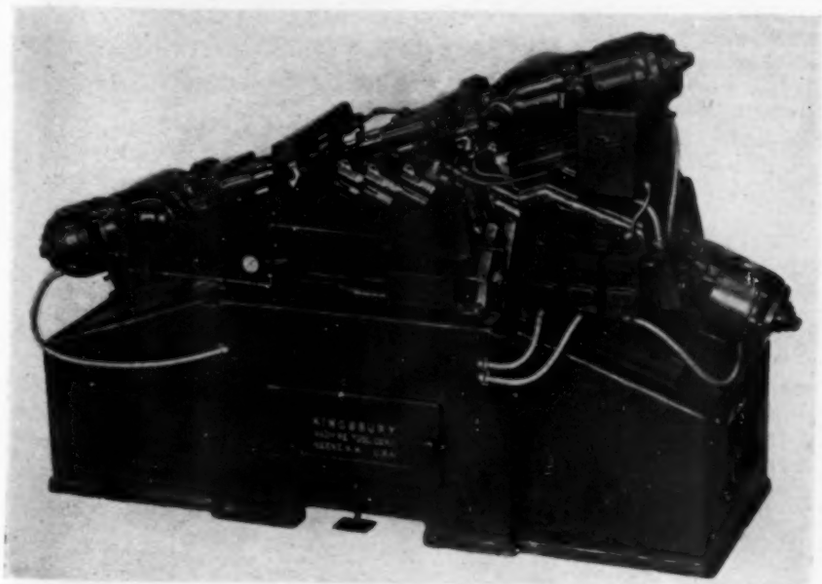
To prevent metal chilling in the metal well between time of loading and casting, a small gas nozze is introduced through the head plate. It requires 15 seconds to complete a machine cycle. Production speed, however, depends largely upon the operator. Castings are automatically ejected from the die by means of knockout pins fastened to a plate in the hub portion of the movable die. As the movable die is opened, the ejector plate is pushed forward by a stop rod in the ram. The ram is made hollow to accommodate this ejector mechanism.

To convert the machine from a pressure die-casting outfit to a permanent mold machine for gravity casting brass, one adjustment screw is turned which causes the metal well to remain stationary in its lowered position. The metal plunger and plunger handle remain inoperative, but the die is closed and opened the same as for pressure casting and core pulls and casting ejection are automatic. The gate for permanent mold castings is on the top of the die.

Kingsbury Type TA Power Indexing, Drilling and Reaming Machines

A new principle is claimed for the Type TA power indexing, drilling and reaming machine in that the work is tilted in its nest, permitting drilling from opposite sides without resorting to the trunnion-type indexing fixture. The machine has been developed by the Kingsbury Machine Tool Corp., Keene, N. H.

The machine illustrated was built for a hinge manufacturer. The work is drilled at station No. 1 from opposite sides by the left-hand and upper right-hand heads and is line reamed at station No. 3 by the lower right-hand head. An intermediate operation on the "uphill" angle is performed at station No. 2, if desired. Three-spindle auxiliary heads are mounted on each drilling or reaming unit, and three workholding nests are mounted on each station of the dial. In this manner, three completed pieces are obtained at each indexing. The hinges going through the machine may be of one size only for very high production jobs, or three different sizes may be run through simultaneously to cover miscellaneous work.



A cabinet-type base contains the power indexing unit, coolant reservoir, and pumping unit, and has chip cleanouts at both ends. At the center, the base supports the horizontal indexing dial and, on the inclined surfaces, the various drilling, or reaming, units.

Indexing is controlled by means of the conveniently located treadle, leaving the operator's hands free for loading. During the drilling operation the operator loads the next set of fixtures. At the completion of the first indexing, a large locking pin automatically locks the dial in place, and three individually air-operated toggle clamps hold the work during the drilling. After the work has been clamped, the holes are drilled and, upon their completion, the work is automatically unclamped. At station No. 3 a duplicate set of clamps functions in like manner and holds the work during the reaming. The work is automatically ejected by means of ejecting pins under the center of the work in each individual work nest.

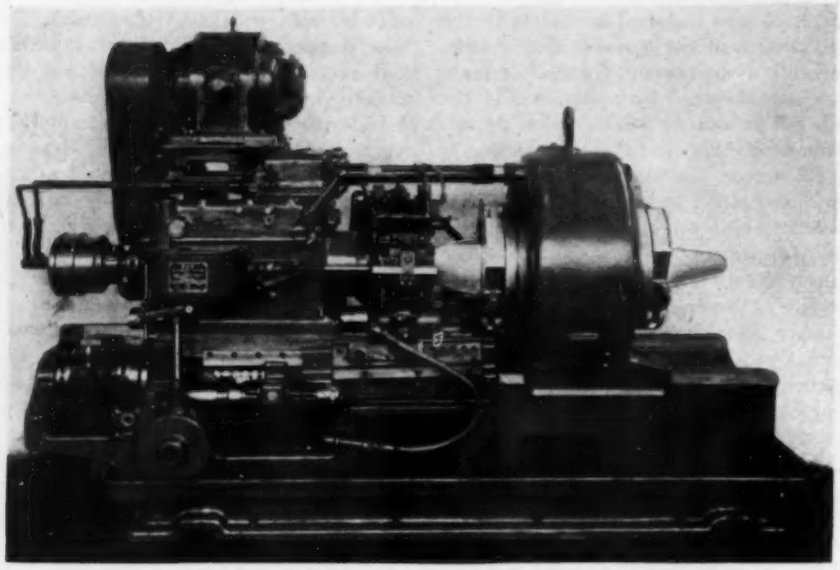
All drilling spindles are provided with longitudinal adjustment, and each drilling or reaming unit is provided with quill adjustment for accurate depth setting. Each is mounted in a dovetail adapter plate with screw adjustment for adjusting the complete unit. Additional cams can be supplied for work requiring different feeds or different strokes. A variety of spindle speeds may be obtained by changing speed gears at the back of the heads. The indexing dial is equipped with locating buttons to permit the use of different style work nests.

Besides the operations on hinges, any work requiring opposed operations with a maximum of three operations from one direction and one from the opposite direction may be handled in this type machine. For example, another machine has been arranged for steering gear case covers. Other operations which may be performed by substituting correct units in place of those illustrated are: core drilling, facing, threading, and tapping. Hand indexing may be furnished in place of the power indexing, if preferred.

Torit Arbor Bands

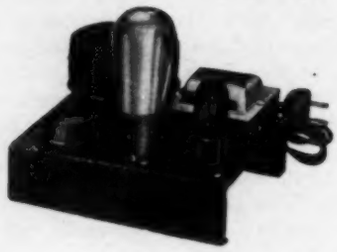
Small rubber wheels about ½ in. in diameter, and abrasive bands to fit, have been manufactured for several years by the Torit Mfg. Co., 174 W. Third St., St. Paul, Minn., for use by the dental profession. The company has experi-

mented with larger wheels and bands in its buffing and polishing department, and is now placing them upon the market. The bands are put on the rubber wheels which are then expanded to tighten the band. The rubber wheel provides the band with a soft cushion, which is of value when various buffing and polishing operations are being done. The wheels and bands range from ½ to 2 in.



G-M "Foto-Switch"

A "Foto-Switch," or photoelectric relay, has been announced by the G-M Laboratories, Inc., 1735 Belmont Ave., Chicago, Ill. This device incorporates an electro-magnetic switch which is opened or closed by the interruption or variation in the illumination on the photoelectric cell. Electrical devices, such as motors, electric signs, signals, or alarms, can be controlled through the medium of a light beam with the use of the Foto-Switch.



Bodine Fractional-Hp. Motors With or Without Speed Reducers

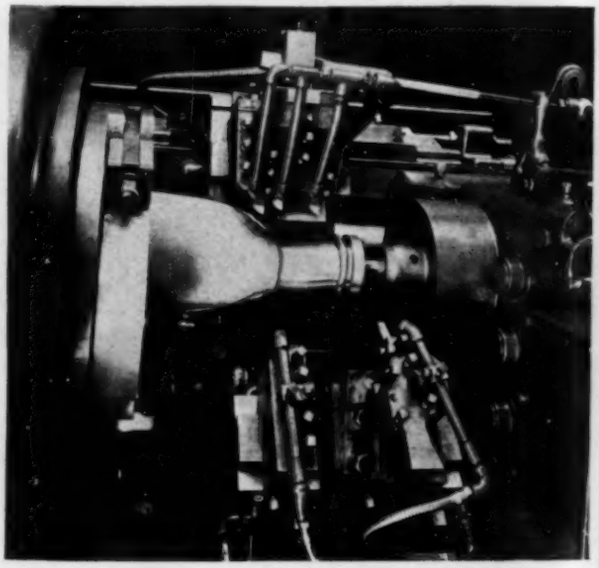
A line of fractional-horsepower motors has been announced by the Bodine Electric Co., 2264 W. Ohio St., Chicago, Ill., which includes the Type NSY-12 self-starting, single-phase, synchronous motor in ratings of 1/75 hp. in the open ventilated frame and 1/150 hp. in the totally inclosed frame at a motor speed of 1,800 r.p.m.; and the Type NSI-12 induction motor in ratings of 1/50 hp. in the open ventilated frame and 1/70 hp. when totally inclosed at a motor speed of 1,725 r.p.m. and 1/100 hp. in the open frame and 1/150 hp. when to-

J & L Special Turning Machine for Propeller Hubs

The Jones & Lamson Machine Co., Springfield, Vt., recently developed a special machine for turning the hub end of various sizes of airplane propeller blades. Basic principles of the 12-in. Fay automatic lathe are incorporated in this machine. The bed is of special double-ribbed box-type construction with the pan cast integral. A special transmission and auxiliary cam drum are provided. All tool movements are obtained through the regular bar construction operated by hardened cams on the outside of the cam drums. The holding or driving unit is equipped with a 14-in. hollow spindle and mounted on ball bearings. Drive for the special holding unit is through a take-off shaft from the headstock with a maximum speed of 530 r.p.m.

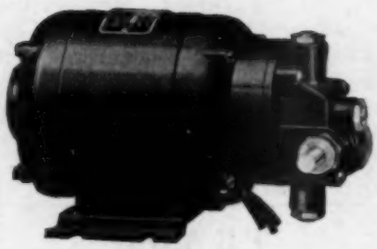
The propeller blade is delivered to the machine straightened and the hub end centered. The driving unit is equipped with a special holding fixture which locates the blade on the camber or concave side, and holds it in position with hinged-type clamps. The leading edge of the blade is previously rough ground and location tabs are incorporated in the fixture to locate the piece on the center line. The hub end is supported on an air-operated center.

Tooling for this machine makes it possible to rough and finish turn, face and form all surfaces on the hub end in one operation. The back arm or back facing member carries an auxiliary slide with the roughing tools and the finishing tools mounted in the conventional way. The carriage or turning head is equipped with two sets of tools and a taper turner for roughing and finishing. Bearings, where the blade is clamped into the hub, are held within a 0.002-in. limit. The machine works through the cycle automatically.



Tool movements are obtained through the regular bar construction and are operated by cams on the outside of the cam drum

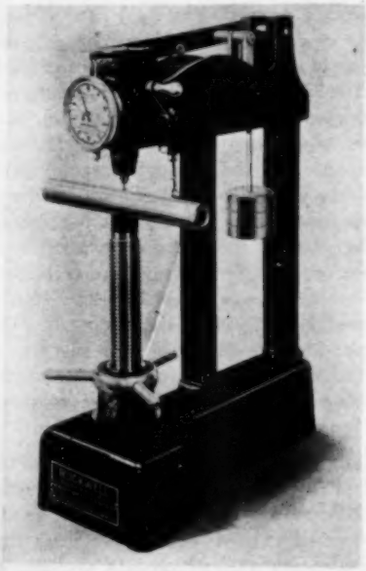
tally inclosed at a motor speed of 1,125 r.p.m. Worm gear speed reducers are available with the following ratios: 8½ to 1; 17 to 1; 30 to 1; 35 to 1; 72¼ to 1; 144½ to 1; 289 to 1; 595 to 1; and 1,120 to 1; other ratios are available if required. These motors are used extensively for instruments and control apparatus.



Rockwell Superficial Hardness Tester

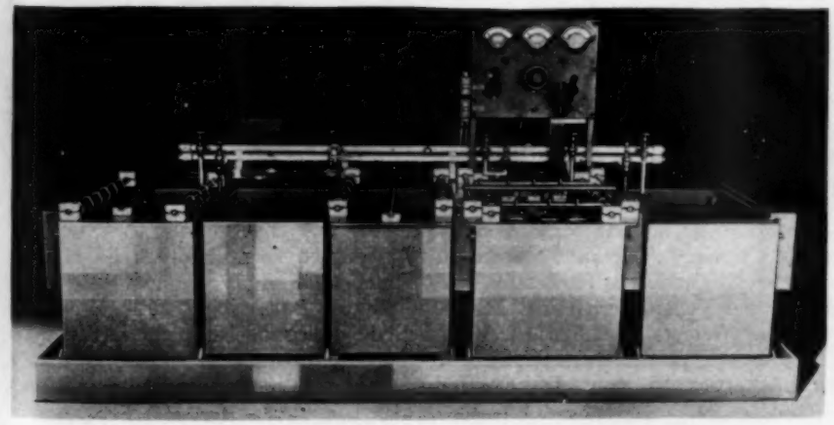
A special-purpose hardness tester, functioning on the Rockwell principle, but not making standard Rockwell hardness tests, is now offered by the Wilson Mechanical Instrument Co., 383 Concord Ave., New York, N. Y. The tester was developed for testing nitrided steel, safety razor blades and thinner sheet metal than the standard Rockwell is capable of handling. It operates with lighter minor and major loads and a more sensitive depth measuring system.

The difficulty in measuring the hardness of nitrided steel has not been due to the hardness resulting from nitriding but has arisen from the thinness of the depth of case. In any penetration hardness test, the depth to which the penetrator sinks depends upon the hardness of the metal to a depth of probably ten times actual depth of penetration. A penetration test in a nitrided specimen must avoid influence of the under-lying core. In testing hardened tool steel in the standard manner, giving a reading of say C60 on the regular Rockwell tester, the depth of penetration is roughly 0.004 in. That depth is too great for testing nitrided steel. The Rockwell superficial hardness tester described, with its customary 30-kg. load, applied to material of that hardness would penetrate approximately only 0.001 in.



"United" Chromium Plating Unit

Drills, taps, reamers, files, dies and punches, and many other tools and parts which can be made to last longer by chromium plating, can now be handled in the compact chromium-plating unit developed by United Chromium, Inc., 51 E. 42nd St., New York, N. Y. The unit is so compact that it may be placed in the toolroom, and immediately connected to current, steam, water and waste outlets. It is simple to operate. The unit comes completely assembled with all parts on one base and is especially intended for machine shops.



• PATENTS •

July 26, 1932

Metal-Working Machinery

Tool Driving Mechanism for Tapping Machines or the Like. Bernard P. Schiltz, Cleveland, Ohio, assigned to The Foote-Burt Co. Patent 1,868,721.

Welding Apparatus. Stanley Whitworth and Leland E. Long, South Bend, Ind., assigned to Bendix Brake Co. Patent 1,868,782.

Solid Die Header. William W. Criley, Cleveland, Ohio, assigned to the Ajax Manufacturing Co. Patent 1,869,006.

Welding Apparatus. John C. Lincoln, Cleveland, Ohio, assigned to the Lincoln Electric Co. Patent 1,869,013.

Arc Welding Electrode Control Mechanism. John C. Lincoln, Cleveland, Ohio, assigned to the Lincoln Electric Co. Patent 1,869,014.

Arc Welding Apparatus. John C. Lincoln, Cleveland, Ohio, assigned to the Lincoln Electric Co. Patent 1,869,015.

Stopping Device for Automatic Lathes and the Like. Alva W. Phelps, Anderson, Ind., assigned to Delco-Remy Corp. Patent 1,869,114.

Machine for Straightening Machine Parts. Louis Sircoulomb, Torrington, Conn. Patent 1,869,225.

Method of and Apparatus for Welding. John C. Lincoln, Cleveland, Ohio, assigned to the Lincoln Electric Co. Patent 1,869,350.

August 2, 1932

Metal-Working Machinery

Drilling and Reaming Device. Frederick L. Seitz, Gary, Ind. Patent 1,869,514.

Cutting Torch Machine. James L. Anderson, Tenafly, N. J., assigned to Air Reduction Co., Inc. Patent 1,869,836.

Multiple Cutting Torch Apparatus. Richard F. Helmkamp, Jersey City, N. J., assigned to Air Reduction Co., Inc. Patent 1,869,848.

Tools and Atttachments

Cylinder Finishing Tool. Olaf A. Johnson and Rollie E. Lingren, Minneapolis, Minn., assigned to Storm Manufacturing Co., Inc. Patent 1,869,377.

Workholder. John Edgar, Rockford, Ill., assigned to Barber-Colman Co. Patent 1,869,413.

Workholding Vise. Andrew W. Swanson, Chicago, Ill., assigned to Illinois Tool Works. Patent 1,869,631.

August 9, 1932

Metal-Working Machinery

Means for Producing Worms or Cylindrical Cams. John George Douglas,

Leagrave, Luton, England, assigned to George Kent, Ltd., London, England. Patent 1,870, 325.

Lapping Machine. Hebert S. Indge, Westboro, Mass., assigned to Norton C. Patent 1,870,328.

Worktable and Mount Therefor. David C. Klausmeyer, Cincinnati, Ohio, assigned to the Cincinnati Bickford Tool Co. Patent 1,870,413.

Hydraulically Operated Drop Hammer. Walter Ernst, Mount Gilead, Ohio, assigned to Hydraulic Press Manufacturing Co. Patent 1,870,499.

Hydraulic Press. Walter Ernst and Howard F. MacMillin, Mount Gilead, Ohio, assigned to Hydraulic Press Manufacturing Co. Patent 1,870,500.

Plural Pressure Pump Control for Hydraulic Presses. Walter Ernst, Mount Gilead, Ohio, assigned to the Hydraulic Press Manufacturing Co. Patent 1,870,501.

Hydraulic Connection for Presses. Robert J. Pardee, Cleveland Heights, Ohio, assigned to the Cleveland Punch & Shear Works. Patent 1,870,527.

Relieved Screw Thread Grinding Machine. Alden M. Drake, West Hartford, Conn., assigned to Pratt & Whitney Co. Patent 1,870,718.

Multiple Spindle Automatic Screw Machine. Anton Gerstadt, Berlin-Charlottenburg, Germany. Patent 1,870,724.

Helical Gear Grinder. Albert Aeppli, Zurich, Switzerland, assigned to Henry S. Otto and Henry Escher. Patent 1,870,764.

Grinding Machine. Max Maag, Schwamendingen, Switzerland, and Robert Salomon, Neuilly-sur-Seine, France, assigned to Societe d'Etudes de Machines a Affuter, Paris France. Patent 1,870,818.

Grinding Machine (Lubrication System) Maxwell I. Mathewson, Providence, R. I., assigned to Brown & Sharpe Manufacturing Co. Patent 1,870,857.

Roll Grinder. Richard C. Lewis, Ansonia, and Carl F. Schnuck, New Haven, Conn., assigned to Farrel-Birmingham Co., Inc. Patent 1,871,002.

Triple Action Power Press. Adolph Seidel and Meredith R. Hatch, Toledo, Ohio, assigned to the Toledo Machine & Tool Co. Patent 1,871,088.

Machine for Cutting Spirally Grooved Cams. Eugene J. Gruenewald, Lafayette, Ind., assigned to Ross Gear & Tool Co. Patent 1,871,174.

Arc Welding Machine. Gustav H. Koch, Wilkinsburg, Pa., assigned to Westinghouse Electric & Manufacturing Co. Patent 1,871,326.

Tools and Atttachments

Adjustable Boring Head. Frederick D. Van Norman, Springfield, Mass., assigned to Van Norman Machine Tool Co. Patent 1,870,350.

Flexible Shaft Machine Attachment. Joseph F. Keller, New York, N. Y., assigned to Pratt & Whitney Co. Patent 1,870,736.

• TRADE • PUBLICATIONS

BEARINGS. A 48-page bearing application book, designated as Bulletin 100, has just been published by the Hyatt Roller Bearing Co., Newark, N. J. The contents are divided into four sections as follows: wound roller-type bearings, solid roller-type bearings, single-row radial bearings and lubrication data. Included in the bearing sections are dimensions and load rating tables, together with typical mounting drawings applicable to each type. Other pages are devoted to elements of bearing design, selection, load computation and correct assembly.

BEARINGS. Bulletin S, issued by Kingsbury Machine Works, Inc., 4324 Tackawanna St., Philadelphia, Pa., is of interest to designers who have occasion to employ Kingsbury bearings in machinery with horizontal shafts, such as centrifugal pumps. It contains dimension lists and capacities for three types of mountings of combined thrust and journal bearings, and similar data on mountings for independent journal bearings.

EMPLOYEES' SUGGESTION SYSTEMS. In the latest report by the Policyholders Service Bureau, Metropolitan Life Insurance Co., 1 Madison Ave., New York, N. Y., there is collected and analyzed data on the plans of more than 100 companies to stimulate interest and facilitate the passing on of ideas from employees. The report describes how such systems have been set up and how they function.

LIFT-TRUCKS. The Clark Tructractor Co., Battle Creek, Mich., has issued a little booklet "To Help You Cut Costs," giving essential details of redesigned machines in the line, together with important dimensions.

METRIC STANDARDS. The U. S. Department of Commerce, Bureau of Standards, has issued Miscellaneous Publication No. 135 entitled "The International Metric System of Weights and Measures." It is for sale by the Superintendent of Documents, Washington, D. C., for $0.05.

MICROMETER. The Van Keuren Co., 12 Copeland St., Watertown, Boston 72, Mass., now has available a leaflet describing the light-wave micrometer recently illustrated in these pages.

MOTORS. Leaflet GEA-1628, issued by the General Electric Co., Schenectady, N. Y., describes squirrel-cage motors built in many different styles and illustrates the controls necessary.

MOTORS. Leaflet L20386-A, published by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., describes the application and features of linestart Type CS squirrel-cage induction motors equipped with sealed sleeve bearings, and available in sizes from 3 to 200 hp.

PACKAGING. Some remarkable photographs illustrate the story of metal edge packaging as developed by the Metal Edge Box Co., Callowhill at 12th St., Philadelphia, Pa. A number of pictures illustrate the packing of machine parts and tools and show the result of tests to show the strength of the resulting package and the protection afforded to the contents.

SPRINGS. In a 48-page book entitled "Springs," the Wickwire Spencer Steel Co., 41 E. 42nd St., New York, N. Y., presents a treatise on springs, wire forms and spring wires, in which is contained previously unpublished data and considerable detail on how the physical properties of oil tempered spring wire may be controlled by variation of drawing temperatures. A set of helical spring design tables, including over 2,000 combinations of wire diameter and coil diameter, has been calculated and by its use helical springs may be designed. The book also contains several pages of formulas and graphs as well as microphotographs, descriptions and solutions of typical problems in spring design.

THRIFT AND UNEMPLOYMENT. Published by the Committee on Indutrial Relations of the National Metal Trades Association is a booklet "Thrift and Unemployment," which is a preliminary to a more extensive treatment of the subject soon to be published and founded upon seven years of research and analysis. Executive offices are at 122 S. Michigan Ave., Chicago, Ill.

TIMESTARTERS. Leaflet L.20554, issued by the Westinghouse Electric & Mfg. Co,. East Pittsburgh, Pa., describes heavy-duty timestarters designed for constant speed d.c. motors in mill service.

WELDING TIPS. P. R. Mallory & Co., Indianapolis, Ind., are now distributing literature describing Elkonite and Elkaloy electrode die materials used for welding tips on spot welding machines, and illustrating replaceable tips. Price sheets are included.